

高等职业教育精品工程规划教材·素质教育系列

电气信息科技英语

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内 容 简 介

本书以掌握电子电气类及信息类专业常用英语的一般特点、常见表达方式和专业词汇,提高阅读和检索英文文献资料的能力及撰写英文论文的能力为目的。本书共9个单元,满足24~48学时科技英语、专业英语的教学需要。每个单元分为4部分,第1部分为素质教育,第2~4部分各自又分为课文A(精读)和课文B(拓展阅读),其中,精读课文配有新单词、词组、注释等相关资料,教师可以根据学生的能力和教学要求灵活选择教学内容。此外,全书每篇文章都配有二维码,读者用手机扫码,即可轻松获得相关文章的配套资料。

精读课文的配套资料为英文全文、中文译文及由英语专业老师录制的配套视频。素质教育与拓展阅读课文的配套资料主要为相关话题的视频或音频(2~5分钟),在减轻学习难度的同时增加了趣味性,利于激发学生的学习兴趣。

为了方便教师教学及提高学生英语的听说能力,本书还配有电子课件、外教朗读课文录音(mp3格式)、实验实训视频及生产现场视频、设备图片及演示动画等多媒体教学资源。

本书可作为本科及高职高专院校电子电气类、信息类专业英语教材或英语素质教育教材,也可作为教学机构的英语培训用书。

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乘新时代春风，放飞青春梦想

2007年，临近大学毕业时，我曾获得了一次从事科技英语研究的就业机会，当时懵懂的我因为缺乏对科技研究的深入了解，误认为从事科技相关的工作会是一件没有温度、缺乏挑战且无比枯燥的工作，于是轻易地放弃了。同年，我进入四川工程职业技术学院工作，并成为了一名光荣的高校教师。四川工程职业技术学院的特色办学目标和专业建设正是立足于国家重大装备制造业的发展，同时为国家培养地方离不开（服务地方经济和产业发展）、同行认可（同类学校认可度高）、国际可交流（体现中国特色，具有全球化视野）的高技能高素质技术型人才。在十余年的职业生涯中，我常有机会了解到制造行业前沿的科技发展动态和科研创新成果。潜移默化，耳濡目染，正是这个长期学习的过程让我逐渐转变了对科技研究的认识。2010年，我开始承担专业英语的教学工作，促使我在提升英语教学能力的同时不得不主动地去探究与专业相关的科技研究进展和成果，从而深刻体会到科技发展对人类社会生活的重要性。如今，能有此机会参与此教材的编写工作并受邀撰写序言，我感到无比荣幸，更感激冥冥之中命运的巧合安排。构思写序的过程中，我一直谨小慎微，迟迟不敢动笔，深忧拙笔无力担此重任。直至提笔写序，我仍诚惶诚恐，然转念激动不已且倍感珍惜，望倾尽所能贡献一份绵薄之力。

近年来，以“立德树人”作为教育根本任务的综合教育理念——课程思政，被屡屡提及并逐渐推广，其具体实施办法为“以构建全员、全程、全课程育人格局的形式将各类课程与思想政治理论课同向同行，形成协同效应。”这与我国目前主流的教育理念不谋而合：“人才培养体系涉及学科体系、教学体系、教材体系、管理体系等，而贯通其中的是思想政治工作体系。”该理念所有的落脚点最终都回归到“立德树人”的人才培养目标上。

2018年，教育部明确提出启动具有中国特色的高水平高职院校和专业建设计划，这是继国家示范性高职院校建设之后又一具有战略意义的重大举措。站在新的历史起点，面对新的历史机遇，立足于我国高职院校当前的发展实践和现实诉求，我们力求真正将高技能高水平的高质量人才培养落实到上好每一门课程、编著符合新媒体时代的现代化教材之上，推动高职教育的现代化发展。本教材的编写正是基于此背景和以“立德树人”为目标的理念而开展的。

这是一本由我学院12位专业课教师和5位英语教师共同完成的教材，从选题、编写到呈现方式都经过了精心构思和编排，融文字、图片、音频、视频及网络后台资料（扫二

维码可得)等多种资源为一体。

教材内容涵盖了互联网时代、AI 技术、智能制造、物联网等前沿科技成果及大部分电气类、信息类相关的专业知识和科技常识,既有令世人瞩目的前沿科技资讯,如 RFID、无人驾驶汽车、3D 打印等,又不乏我国自主研发的国际领先科技成果,如中国首款具有自主知识产权的大型客机 C919、墨子号量子通信卫星等。教材还编录了通俗易懂的专业知识,如 Web 编程、安全标识、电路、数字系统等;增加了实用有趣的科学常识,如计算机启动与故障排除、消除静电小妙招、触电急救等;列入了中外闻名的科技大事件;编入了大众喜闻乐见的科普见闻,如比尔·盖茨的智慧之家、黑客与骇客等。丰富而独具特色的教材内容定能让读者萌生探索前沿科技的兴趣,引发读者对科技创新的深入思考,唤起读者关注中华民族科技命运的爱国情怀,激发读者对我国科技事业发展成就的民族自信和自豪感。

教材的另一大特色在于精心编入了饱含所有编写老师良苦用心的、具有代表性的中外科技行业领军人物及科技专家的成长故事,如深度学习之父 Geoffrey Hinton、击溃密码算法的中国密码学家王小云、被称为数控“肌肉”维修师的“四川工匠”胡明华等。相信科技专家们的成长故事定能帮助读者驰骋想象并从中感受榜样的力量,激发读者勇攀科技高峰的内在动力。

此外,本教材还是一本集视觉、听觉、美感为一体的多功能英语教学资源合集。27 篇精读课文除了包含系统化的英语教学内容,还以分句版和全文录屏的微课形式将内容全方位地呈现给学生。36 篇素质教育和拓展阅读课文都加入了丰富有趣的视频、音频等后台参考资料。读者只要扫描二维码即可方便快捷地获取微课和后台教材资源。因此,它能以立体化的多种呈现方式充分调动读者的感官,这对帮助各层次的学生和爱好科技的读者充分掌握教材内容,实现高趣味性的无障碍学习,培养和提升科技素养等具有重要的价值。它还能高校从事电气信息类专业英语、科技英语教学的老师和研究者提供丰富的教学和研究素材,满足新媒体时代下对科技教材的多种教学及研究需求。

从 18 世纪中叶开启工业文明以来,世界强国的兴衰史和中华民族的奋斗史一再证明了:没有强大的制造业,就没有国家和民族的强盛。当前,中国制造业与世界先进水平相比仍然存在大而不强,转型升级和跨越发展的任务紧迫而艰巨的问题。“中国制造 2025”战略的提出,其根本目标也是在于改变中国制造业“大而不强”的局面,全面提升中国制造业发展质量和水平。新一轮科技革命和产业变革与我国加快转变经济发展方式已形成历史性交汇,国际产业分工格局正在重塑。我国必须紧紧抓住这一重大历史机遇,把国家建设成为引领世界制造业发展的制造强国,为实现中华民族伟大复兴的中国梦打下坚实基础。在这一重要时代背景下,每一位从事科技研究工作的专家、学者、师生都应责无旁贷地肩负起实现这个目标的时代使命和重任。让我们响应时代号召,乘着新时代春风,在祖国的万里长空放飞青春梦想,以社会主义建设者和接班人的使命担当,为全面建设社会主义现代化强国和实现中华民族伟大复兴而努力奋斗!

四川工程职业技术学院 高琦

2018 年 8 月 12 日

本书将内容分为素质教育、精读与拓展阅读三种形式，采集编录了电气信息类专业的专业基础知识和前沿科技资讯，力求帮助学生提高电气信息类专业英语水平，拓展学生的专业能力，提升专业工程素养。在提供丰富专业知识的同时，本书还收录了中国密码学专家王小云、“四川工匠”胡明华老师等中外科技领军人物及行业专家的精彩故事和人生感悟，以榜样的力量激发学生对英语、技能技术的学习热情，增加学习的趣味性和生动性，并立足于“教书”与“育人”，培养学生良好的职业素养、团队协作精神，让学生在潜移默化中感悟做人、做事的道理。

本书共 9 个单元，满足 24~48 学时科技英语、专业英语的教学需要。每个单元分为 4 部分，第 1 部分为素质教育，第 2~4 部分均分为课文 A（精读）和课文 B（拓展阅读），其中，精读课文包含了新单词、词组、注释等相关资料，教师可以根据学生的能力和教学要求灵活选择教学内容。此外，全书的每篇文章都配有二维码，读者只需用手机扫码，就可以轻松获得相关文章的后台资料。精读课文的后台资料为英文全文（Word 格式、分句版 Word 格式）、中文译文及由专业英语老师录制的配套视频。素质教育与拓展阅读文章的后台资料主要为 2~5 分钟的相关话题小视频或音频，在减轻学习难度的同时增加了趣味性，利于激发学生的学习兴趣。

本书由殷佳琳、高琦老师任主编，赵冠南、张雪老师任副主编，黄景广老师任主审。殷佳琳老师负责整体策划、设计。编写过程中，全体老师精诚团结、分工协作，充分发挥各自特长的同时合作完成了多项任务。全书的编写过程历经了 4 个阶段。

第 1 阶段为：话题和题材选取、中文稿件初写、中文稿件修改、中文稿件交叉检查、中文稿件核校、中文稿件定稿；英文稿件初写、英文稿件修改、英文稿件交叉检查、英文稿件核校、英文稿件定稿。

第 2 阶段为：确定精读课文每句的新单词词义、短语和词组、翻译解析等。

第 3 阶段为：精读课文分句版的录课、全文的录课等。

第 4 阶段为：素质教育与拓展阅读文章的后台资料选录、审核、定稿。

从题材选取到最后的定稿，每个阶段的编写内容都经过多次反复推敲、修改、再推敲、再修改，直到最后定稿。

全书各单元文章编写分为中文部分与英文部分。中文部分各单元编写分工：单元 1 由高茜、黄景广老师负责；单元 2 由易欣、钟艳老师负责；单元 3 由黄景广、赵冠南老师负责；

单元4由张文君、殷佳琳、王静老师负责；单元5由高琦、范娟老师负责；单元6由段国艳、黄景广老师负责；单元7由殷佳琳、易欣、范娟负责；单元8由初宏伟、高琦老师负责；单元9由赵冠南、钟艳老师负责。英文部分各单元编写分工为：邓锋老师编写单元1、单元9；钟敏老师编写单元2、单元6；罗建芳老师编写单元3、单元8；魏庆星老师编写单元5；张雪老师编写单元4、单元7。中文部分的核校、定稿工作主要由殷佳琳、黄景广、赵冠南老师负责，英文部分的核校、定稿工作主要由高琦、张雪老师负责。

本书参阅了相关教材、书籍和网络资料，在此对上述材料的作者致以深深的谢意！由于水平有限，书中疏漏和不足之处在所难免，敬请读者不吝指正。

编者

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Unit 1

The Internet Age

1.1



China's Mobile Payment Are Leading the Globe

Many foreign friends coming to China for the first time now have discovered that China's mobile payment life is so amazing: from going out in the morning to coming home at night, people can complete booking and paying operations all through a smart phone without paying any cash, even for one time, including dinning, taking bus and subway, traveling, shopping, check-out, and so on (Figure 1-1). It's really fast and convenient.

In 2017, China's mobile payment has led the world with no suspense. Whether in the most developed countries such as the United States and Japan or in Europe, there is no way to rely on mobile phones and QR codes to live the nearly cashless daily life like it is in China. Going out without wallets but with mobile payment is becoming the normal life for Chinese people. On the street, old lady selling apples uses mobile payments; in Hangzhou, the hometown of Alipay, even beggars at the roadside support the mobile payments by scanning QR code (Figure 1-2).



Figure 1-1 Mobile payments can
be available everywhere



Figure 1-2 Recommending WeChatPay

In 2016, the scale of mobile payment in the U.S. is 112 billion dollars. In the same year, it is 9 trillion dollars in China, taking up nearly half of the global mobile payment market, far ahead of the rest countries and regions of the world. In 2017, Alipay has been launched in 33 countries and regions in Europe, America, Southeast Asia, etc. It covers almost all consumption scenarios including catering, supermarkets, department stores, convenience stores, duty-free shops, theme parks, overseas airports, tax rebates and so on; WeChat has also landed in over 13 countries and regions, covering more than 130,000 overseas merchants, and supporting more than 12 foreign currency settlement (Figure 1-3). On January 25th, 2018, Israel became the 38th country in the world to support the payment of Alipay by scanning QR code, which broke its record again.

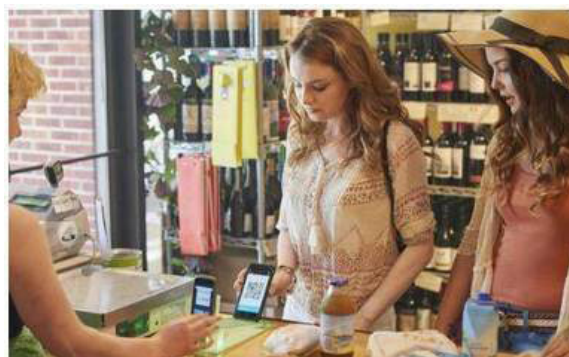


Figure 1-3 China's mobile payments are popular around the world

As we all know, before 1987, China had not abolished food stamps yet. However, just 30 years later, when most of European and American countries are still in the credit card period, China has entered the era of mobile payment directly (Figure 1-4), and is at the forefront of the world's financial industry now. According to statistics, China's mobile payment transaction volume reached about 29.5 trillion yuan in 2017, which makes China the largest mobile payment market in the world. And just a few years ago, this figure was close to zero. China's leap-forward development pattern is becoming a model for other countries to learn from.



Figure 1-4 Chinese people can go out without cash

1.2A

Mobike



Mobike is a solution to short trips through the Internet developed by Beijing Mobike Technology Co., Ltd (short for “Mobike”). People can rent it with smartphones to quickly complete a short trip. Mobike has also successfully promoted a healthy, environment friendly and fashionable life concept (Figure 1-5).



Figure 1-5 Mobike

The small mobike contains at least 28 patents, so its technological content is rather rich, such as:

(1) Miraculous bike lock: it includes many practical functions like antitheft, positioning, timing, odometer and so on, applying advanced technologies in Internet Of Things industry such as big data, cloud computing, GPS positioning, etc.

(2) Self-charging: the bike lock is obviously in need of electricity, but have you ever seen any worker charging it? No! Because when you are cycling the charging process is completed.

Knowledge is power; science and technology change life. Mobike is such a kind of example.

Mobike is the founder and leader of global shared bikes. Till November 2017, Mobike had entered more than 200 cities in more than 10 countries, and had operated more than 7 million shared bikes with more than 200 million users worldwide. It is the world's largest Internet travel service company, and has been evaluated by domestic and overseas media as one of China's "Four Great New Inventions".

On November 3rd, 2017, Mobike announced to hold hands with Guian New Area and Sitech. Both companies intended to cooperate in the field of shared cars, henceforth, Mobike entered the field of shared cars and named it Mocar (Figure 1-6).



Figure 1-6 Mocar

New Words

Mobike ['məʊbaɪk] n. 摩拜共享单车; 北京摩拜科技有限公司

solution [sə'lju:ʃn] n. 溶液; 解决; 溶解; 答案

rent [rent] v. 租用; 出租

miraculous [mɪ'rækjələs] adj. 神奇的; 奇迹般的; 不可思议的

odometer [əʊ'dɒmɪtə(r)] n. 里程计

compute [kəm'pjʊ:t] v. 计算, 估算; 推断; 用计算机计算
n. 计算

Phrases and Expressions

smart phone: 智能手机

short trip: 短途出行

life concept: 生活理念

Internet of things industry: 物联网行业

Internet travel service company: 互联网出行服务公司

domestic and overseas: 国内外

evaluate...as...: 评价……为……

Notes

(1) Mobike had entered more than 200 cities in more than 10 countries, and had operated more than 7 million shared bikes with more than 200 million users worldwide.

and 连接着两个并列的成分 → Mobike had entered and had operated → and 前面省略了 Mobike。

(2) Miraculous bike lock: it includes many practical functions like antitheft, positioning, timing, odometer and so on, applying advanced technologies in Internet of things industry such as big data, cloud computing, GPS positioning, etc.

like 为介词, 意为“像, 比如” → 它包含了很多实用的功能, 比如: 防盗、定位、计时、计里程等 → 它包含了防盗、定位、计时、计里程等很多实用的功能; applying advanced technologies in Internet of things industry such as big data, cloud computing, GPS positioning, etc. → applying 的作用是现在分词表伴随, 作为状语。

1.2B



China's Internet Age

In the era of US-Soviet hegemony, out of fear of nuclear weapons, the US military needed to design a national network. The demand was that even if the other side destroyed part of the network, the rest could still command the nuclear counter attack normally. So in 1969, the predecessor of the Internet, Arpanet was born, and informatization technology first started in the United States.

China's informatization lags behind the starting line. Fortunately, this is one of the few areas in our country that are not so far behind. On April 20th, 1994, China accessed the Internet with full function through a 64KB/s international dedicated line. China's information age started from then on.

In 1996, the first Internet enterprise InfoHighWay was born. In June 1997, Ding Lei founded NetEase; in 1998, Zhang Chaoyang established Sohu; in December 1998, Wang Zhidong founded Sina. The three portals also became the first batch of pioneers of Chinese Internet.

When Ding Lei founded NetEase in 1997, all of the company's hardware assets were its own DIY PC——Pentium PRO, and all its software products were NetEase BBS. Then it was found that only BBS was too wasteful of resources, so he searched around the Internet for good personal pages and begged their host to move “home” to NetEase, forming the second product of NetEase——free personal home page. The third product, free mailbox, was a huge success. Rocket-like NetEase listed on Nasdaq in 2000.

In November 1998, Tencent was established, and then in 1999 chat software QQ appeared, which was called OICQ at that time. On September 9th, 1999, Ma Yun formally established Alibaba Group in Hangzhou. On January 1st, 2000, Li Yanhong founded Baidu. Thanks to the explosion in the number of Chinese Internet users, China's Internet has caught up with foreign countries at a rapid pace.

Total sales of Alibaba, Tmall and Taobao reached 19.1 billion yuan in 2012. The turnover on the Tmall Double Eleven Carnival was 168.2 billion yuan in 2017. Then there has sprouted a lot of social networking sites, group-buying sites, webcasts, ride-hailing software, Today's Headlines and so on.

China Internet Network Information Center (CNNIC) released its forty-first report, Development of China's Internet Network, in Beijing, saying that by December 2017,

China's Internet users had reached to 772 million, with a penetration rate of 55.8 percent, 4.1 percentage points above the global average. Among them, mobile phone netizens are 753 million. The total number of mobile applications in China has exceeded 10 million, and China has fully entered the mobile Internet age.

At the first Digital China Construction Summit on April 23th, 2018, Wang Xing, the chief executive of Meituan Review Group, said: "The Internet has entered a new phase of the digital economy after 20 years of development in China."

The spring of the Chinese Internet has finally come, and now we are the well-deserved Internet leaders in many fields!

We are living in the spring of the Internet in China. With the development of mobility, intelligitization, big data, cloud computing and other technologicis, the opportunities are more abundant than ever. Please step in the footsteps of your predecessors, let your mind fly and stretch your hard-working hands to pick them!

1.3A



The Impact of the Internet Age on the State

The Internet has developed into a global information network with numerous users, communities and even functional groups, having a new impact on the national concept.

(1) The status of the state is weakened.

The virtual network community transcends the concept of country and region, as well as the administrative power control. New international political roles, such as NGOs, transnational corporations and special interest groups, share the power of state's subjects in international affairs.

(2) National judicial difficulty increases.

The emergence of the Internet has made cybercrime and transnational crime more rampant. Huge flow of information and the contradiction between privacy protection and identity authentication has made it more difficult to collect evidence of crime (Figure 1-7).

(3) It makes national tax loss.

The Internet has promoted the rapid development of e-commerce, and impacted the state's control over the economy. One of the outstanding manifestations is the tax revenue loss (Figure 1-8).

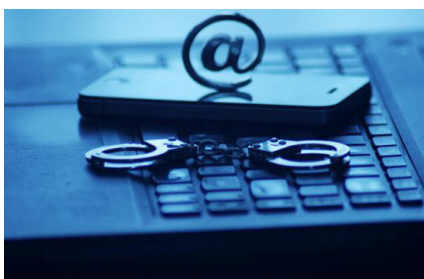


Figure 1-7 Information safety

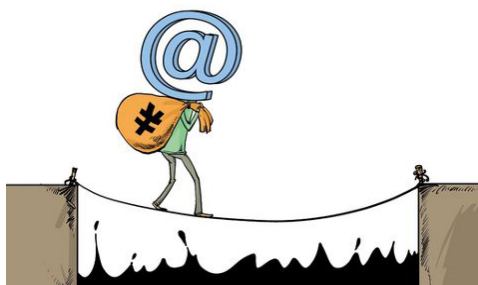


Figure 1-8 National tax loss

E-commerce has been operating in an unprecedented way in the market. It has made the national tax jurisdiction established on the basis of principles of territorial jurisdiction and personal jurisdiction face challenges.

(4) National security has been challenged.

Cyber warfare does never just aim at enemy troops. Communications networks, financial

systems and the government departments are all targets of attack as long as they can achieve their strategic goals. Psychological warfare and cultural infiltration are new online fronts. The traditional national security has been challenged forcefully (Figure 1-9).

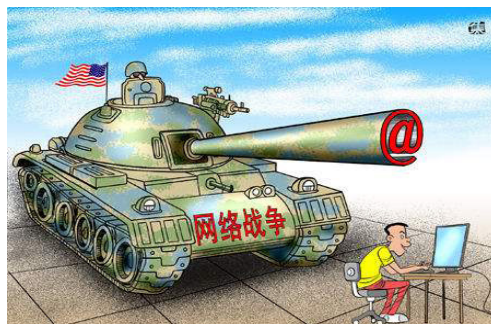


Figure 1-9 Cyber war

Therefore, the state should adapt itself to the development of the Internet age in a positive way and try to minimize its impact.

New Words and Expressions

impact ['ɪmpækt] n. 影响; 碰撞, 冲击, 撞击; 冲击力

develop [dɪ'veləp] vi. 发展; 形成; 生长; 发达

vt. 发展

numerous ['nju:mərəs] adj. 数不清的; 很多的, 许多的; 数量庞大的

community [kə'mju:nəti] n. 社区; 共同体; 社会团体; [生态] 群落

functional ['fʌŋkʃənl] adj. 功能的; [数] 函数的; 有多种用途的; 机能性的

transcend [træn'send] vt. 超越, 超出……的限度; 优于或胜过……

warfare ['wɔ:feə(r)] n. 战争, 战争状态; 斗争, 冲突; 军事行为; 战火

infiltration [ɪnfil'treɪʃn] n. 渗透; 渗入

Phrases and Expressions

Internet Age: 互联网时代

functional group: 职能团体

national concept: 国家概念

face challenges: 面临挑战

adapt...to: 使……适应

as long as: 只要；如果；既然；由于

Notes

(1) The Internet has developed into a global information network with numerous users, communities and even functional groups, having a new impact on the national concept.

整个句子的主语是 The Internet → 谓语是 has developed into → 宾语是 a global information network with numerous users, communities and even functional groups → having a new impact on the national concept 为 ing 形式引导的分词短语。

(2) It has made the national tax jurisdiction established on the basis of principles of territorial jurisdiction and personal jurisdiction face challenges.

It 是主语 → has made 是谓语 → the national tax jurisdiction established on the basis of principles of territorial jurisdiction and personal jurisdiction 是宾语 → face challenges 是宾语补足语。

1.3B



Personal Worries Caused by the Internet Age

In the age of Internet, the Internet has changed the way people live and work. It brings great convenience to our life and work, but also brings some worries. The network is a double-edged sword, only to remove the disadvantages and bring out the benefits can fully play its positive role in human civilization.

Privacy

In April 2018, according to the BBC news, data of about 87 million users of the Facebook was leaked.

In the Internet age, privacy has gone away from us. Phone numbers, addresses, bank card numbers... the network traces on platforms such as Alipay have long mapped out the Internet portraits of each of us and permanently reside on the web. The e-commerce knows

your spending habits, chauffeured car knows your whereabouts, and mobile payment controls your property changes. With the explosive development of these new technologies such as O2O application and big data, platform operators can collect, grab and analyze the users' daily behavior data anytime, anywhere and without their knowing. We have become the “transparent people” of this era, facing with the risks of financial fraud, cyber violence and reputational damage resulting from privacy disclosure.

“Cyber Manhunt” has been a common occurrence in the Internet age. A joke, a part of video, may inadvertently cause “network violence”. In 2013, an American female public relations official Justin Sacco sent a joking state of Twitter on a plane to Africa, which has caused the Americans “encirclement and suppression” in 11 hours, making Justin lose her job and her spirit collapsed.

Emotion

The Internet has made people feel wrongly more socialized than ever before, but scientific research has found that people who rely heavily on the Internet are less emotional. In a study of 2015, scientists made a survey on the relationship between the Internet and the level of empathy in Chinese younger generation. They found that the greater the number of students with the pathological Internet use (PIU) was, the lower their empathy abilities were. And the study has also found that the level of empathy for American college students has fallen by 40 percent since 2000. Scientists generally believe that face-to-face communication is more likely to enhance human feelings, while the Internet has reduced the amount of time spent on socializing and people spent more time alone (Figure 1-10).



Figure 1-10 Smart phones social mode is more popular

Work

The informatization and AI that comes along with the Internet will take many jobs away from us. For example: in terms of language translation, the current AI is surpassing mankind; industrial robots have surpassed humans in many positions; when it comes to the driver, driverless cars will soon become ubiquitous; about cashiers, unattended banks and unattended supermarkets have emerged. With all the simple physical and mechanical labor, who would be less fear of boredom and tiring work than a robot?

Dawn

Although the Internet has brought us great impacts, it also constantly breaks through our cognition and makes our life more exciting. Maybe we will lose our privacy but we can enjoy the convenience. Maybe we'll lose a simple and repetitive job, but we can find jobs that are more suitable to the needs of the age.

As the so-called “water can carry the boat, but it can also overturn the boat”, we should have the right attitude towards the Internet. We should make use of its “benefits” to enrich the content of our life and improve our work efficiency. We should also see its “disadvantages”, and must check erroneous ideas at the outset.

We should not only guarantee the network security, maintaining the cyberspace sovereignty, national security and social public interests, but also protect the lawful rights and interests of citizens, legal persons and other organizations and promote the healthy development of the economic and social informatization. Methods are always more than difficulties! The Network Security Law of the People's Republic of China was formally implemented on June 1st, 2017.

1.4

Digital Earth



“Digital Earth” is the use of digital technology and methods to store data of the earth and its activities and the environment's patio-temporal changes into computers all over the world, sorted out according to the earth's coordinates, to form a global digital model that rapidly circulates on the high-speed network, so as to make people quickly, intuitively and

fully understand the planet we are living on. The “Digital Earth” will provide maximum quality services for sustainable development and social progress of mankind as well as for national economic development, trying to finish by the coordinates of the earth, in the global distribution of computer, a digital model of a global, rapid circulation in high-speed network, let people quickly complete and intuitive understanding of our own planet. The “Digital Earth” will provide the best quality service for the sustainable development and social progress of mankind and the construction of national economy.

All need to use the “Digital Earth”, for instance: crustal movement, geological phenomenon, earthquake prediction, weather forecast, land dynamic monitoring, resource investigation, disaster prediction and control, and environmental protection. The continuous accumulation of data will eventually make it possible for humans to better know about and understand the planet we survive and live on, and to use massive information of earth to carry out the three-dimensional description of the earth in multi-resolution, multi-space-time and multi-types.

The Digital Earth will contain a large amount of information added by industry sectors, enterprises and individuals, to carry out research and analysis of large amounts of data in spatial and temporal distribution, such as national infrastructure construction planning, national railway and transportation planning, urban development planning, coastal zone development, and western development. From the view close to people’s lives, real estate company can link real estate information to the Digital Earth; tourism companies can put photos and videos of hotels, tourist attractions, even landscapes on the public Digital Earth; the world’s famous museums and libraries can put in their collections in the forms of images, sounds, and words on the Digital Earth; even stores can turn goods on the shelf into multimedia or virtual products in the Digital Earth to allow users to choose freely. Therefore, the advancement of the Digital Earth process will have a tremendous impact on social economic development and people’s lives.

The core of the Digital Earth is geospatial information science. The most basic and fundamental technical core of the technology system of geospatial information science is the “3S” technology and its integration. “3S” is the general terms of global positioning system (GPS), geographic information system (GIS) and remote sensing (RS).

Space based “3S” integration (Figure 1-11, 1-12): it is direct observation of earth by air to ground positioning mode, and its main purpose is to achieve direct ground positioning, reconnaissance, guidance and measurement of aerospace remote sensing information without ground control points (or with a small number of ground control points).

Ground based “3S” integration: it is the real-time operations of vehicle-mounted and ship-based positioning navigation, and positioning, tracking and measurement of ground

targets.



Figure 1-11 Integration of “3S”



Figure 1-12 Classification of oil film on ocean surface

In the modern war and national defense construction, the Digital Earth is of great significance: establish various military geographic information systems that serve for strategies, tactics and battles, and use virtual reality technology to build digital battlefield, including terrain and geomorphology reconnaissance, military target tracking and monitoring, aircraft positioning, navigation, weapon guidance, attack effect reconnaissance, battlefield simulation, operational command and so on; establish the military geographic information system of the war zone and its surrounding areas before the war; carry out the battlefield reconnaissance, information updating, military command and dispatch, and precision guidance of weapons by GPS, RS and GIS in the wartime; evaluate military strike effect in the wartime and afterwards.

The future of the Digital Earth is the Digital Universe. It indicates the greater development space and longer development time of the earth.

Unit 2

Computer System

2.1



Big Data

In the society nowadays, technologies of Internet, Artificial Intelligence and Internet of Things have brought about complexity, diversity and universality of data. Big data is the product of this high-tech age.

Big data refers to a collection of data that cannot be captured, managed, and processed by conventional software tools within a certain period of time, and it is a massive, rapidly increased and diversified information asset that requires new processing models with stronger decision-making power, insight and process optimization capabilities.

How “big” is big data? Data on the Internet will grow by 50% per year, according to the U.S. Internet Data Center. In one day, the entire content produced by the Internet can be engraved on 168 million DVDs. According to the prediction of IDC, the world will have a data size of 35 ZB by 2020.

The age of big data has arrived, and in business, economics and other areas, decisions will increasingly be made according to data and analysis rather than experience and intuition. Data is expanding rapidly and becoming bigger. It determines the future development of enterprises. Big data has become the third productivity besides labor force and capital.

IBM offers the 5V features of big data: Volume (large volume), Velocity (high speed), Variety (diversity), Value (low value density), and Veracity (authenticity).

Some people compare the data to an energy-rich coal mine. The strategic significance of big data technology is not “big” but “useful”. Value content and mining cost are more important than quantity. For many industries, how to make use of these massive data is the key to winning competition. Through the combination of big data and high performance

analysis, it is beneficial to countries and enterprises. Big data applications in fact have already penetrated into every aspect in people's lives: Amazon uses big data for the customer to recommend commodities information, Alibaba uses big data to set up small micro financial services groups, and at present many industries are beginning to increase demand for big data. The age of big data not only processes huge amounts of data, but also disseminates and shares them.

Fields of e-commerce, O2O, logistics and others which are taking advantage of big data for development are assisting enterprises constantly to develop new business and create innovative business models. Through data mining and analysis, it can be very accurate to judge consumers' behaviors, forecast product sales volume and precise marketing scope, completely improve and optimize supplies of inventory and so on.

Big data is another disruptive technology change in the IT industry after cloud computing and the Internet of Things. Cloud computing mainly provides a place and channel for the storage and access of data assets, but data are truly valuable assets. How to activate these data assets to serve national governance, corporate decision-making and even personal life is the core issue of big data.

In 2012, the Obama administration announced an investment of 200 million US dollars to promote the development of the industry related to big data, making the "big data strategy" a state will.

In 2015, Guizhou province started to build China's first comprehensive experimental zone. It carried out the first try and explored new mode of big data application around data possession, data use, and data management to build seven big data platforms for better serving the national development strategy of big data (Figure 2-1).



Figure 2-1 "Time tunnel" of Guizhou big data display center

In March, 2016, China's 13th five-year plan clearly proposed to implement the national big data strategy, accelerate the opening and sharing of government data, and promote the healthy development of the big data industry.

Big data is bound to release greater value, which is the inevitable path to the future.

2.2A



Components of a Computer System

The computer system consists of hardware and software. Hardware is an “organic” combination of various physical components, and software consists of programs and data files.

Now, let's know each of computer hardwares through a motherboard (Figure 2-2).

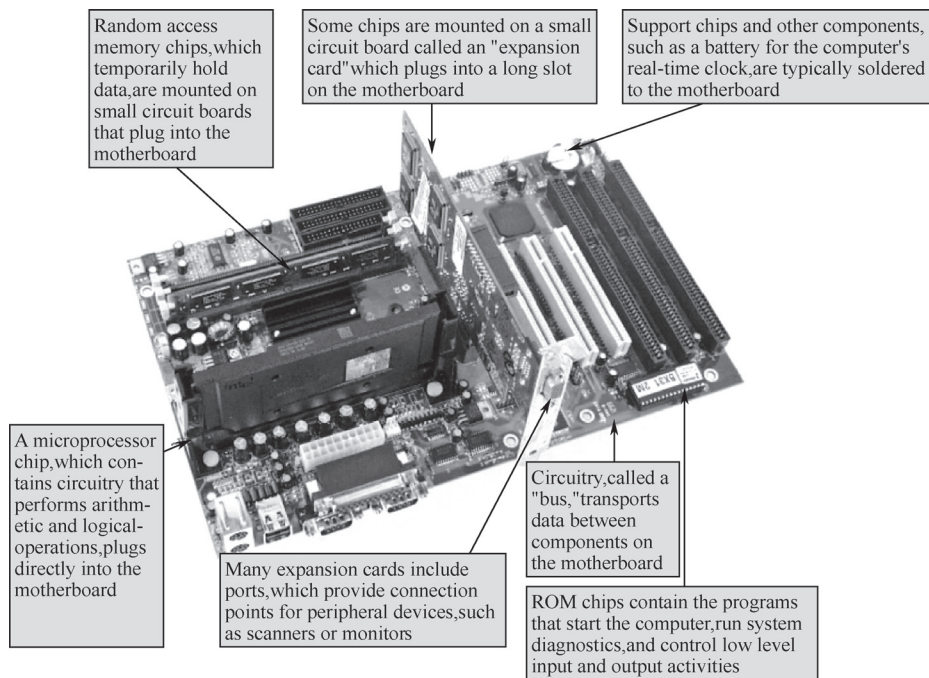


Figure 2-2 Motherboard

(1) CPU. The CPU (Central Processing Unit) is the core component of a computer. It is responsible for executing programmed instructions, which is like a human's brain.

(2) Storage System. The most important storage system is memory and hard disk. Any content that needs to be dealt by CPU has to be input into memory first. The larger the memory is, the more programs can run at the same time. The hard disk classifies and stores the temporarily unused data.

(3) Keyboard and Mouse. They are computer's input system, like a person's eyes and ears, which are used to receive external signals.

(4) Video Card and Sound Card. They are computer's output system. The display is connected to the video card interface, and the speaker and headphone are connected to the sound card interface.

(5) Network Interface. They allow different computers to communicate information through the network.

The hardware is like the human body, while the software is like the human consciousness. The operating system and all kinds of application software are installed in computer, and then the various data information is sent to CPU so that the computer can run normally.

New Words

keyboard['ki:bɔ:d] n. 键盘; 琴键; 电子琴

mouse[maʊs] n. 鼠标; 老鼠

external[ɪk'stɜ:nl] adj. 外面的, 外部的

interface['ɪntəfeɪs] n. 界面; [计] 接口

speaker['spi:kə(r)] n. 扬声器; 说话者; 演讲者

headphone['hedfəʊn] n. 听筒; 双耳式耳机

Phrases and Expressions

all kinds of: 各式各样的; 各种各类的; 五花八门的

so that: 以便; 结果; 以致

Notes

(1) It is responsible for executing programmed instructions, which is like a human's brain.

be responsible for sth./doing sth. → 对某事或某行为负责

which 引导非限制性定语从句, 指代前面的主语 CPU。

(2) They are computer's input system, like a person's eyes and ears, which are used to receive external signals.

which are used to receive external signals → 用来接收外界信号, which 引导非限制性定语从句, 指鼠标键盘用来接收外界信号。

(3) The display is connected to the video card interface, and the speaker and headphone are connected to the sound card interface.

be connected to → 与……连接, 被动语态直接翻译成主动语态 → 显示器连接在显卡接口上。

2.2B



Boot Process and Common Failures of Computer

The period from pressing the start button to the time when the computer is ready to accept the input command is referred to as the boot process of computer. In general, the boot

process follows these five steps.

(1) Power on. When you turn on the power switch, the power indicator light is on, and the current is transmitted to the motherboard and other equipments.

(2) Start the boot program. The CPU begins to execute the instructions stored in ROM.

(3) Power-on self-test. The computer starts to perform diagnostic tests of several crucial hardware systems.

(4) Load operating system. The operating system is copied from a disk to RAM.

(5) Ready for accepting commands and data.

Let's take a look at some common failures during the boot process of computer.

1. Power on

The first stage in the boot process is the power-on stage, and the power indicator light on the case of computer comes on. If the power indicator is not on, there is no current in the system. You should check the power interface at the back of the computer to make sure it is firmly plugged into the socket on the case and wall. Also, make sure that the socket on the wall is electric. If the power indicator light is still not on, then the computer's power supply might have failed (Figure 2-3).

When you turn on a computer, you should see the power light and hear the fan

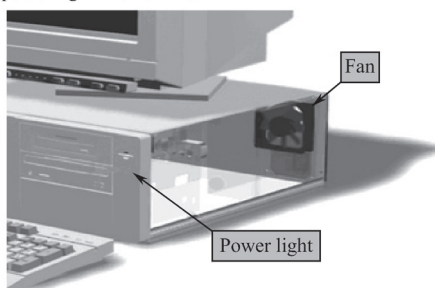


Figure 2-3 Check the light and the fan when powering on

2. Start Boot Program

The boot program in ROM is loaded into memory, and the CPU starts executing the boot program. If the power indicator light is on and the fan can be heard rotating, but no information is displayed on the screen, it is likely that there is something wrong with the ROM (Figure 2-4).

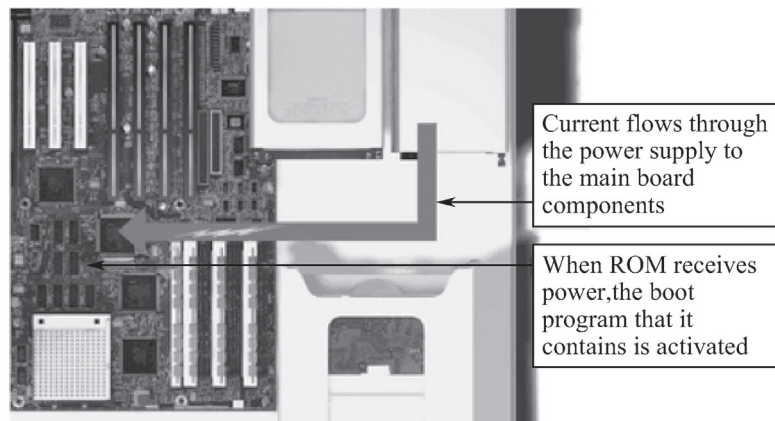


Figure 2-4 Most computers beep once when running

3. Power-On Self-Test

The boot program will first detect the video card when POST begins. If the video card is working, you'll see a message such as "Video BIOS ver 2.1 2000" on the screen. If the computer doesn't display this information, there may be something wrong with the video card. Next, the computer detects the memory. If the memory goes wrong, the computer will beep. The final step in the POST is the drive test. You will see the drive's indicator light flashing and hear the sound of its turning. If the computer pauses during this test, it means that some of the drives are malfunctioning (Figure 2-5).

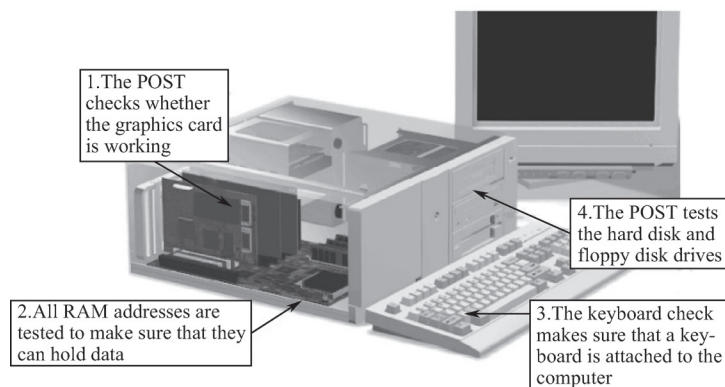


Figure 2-5 The self-testing

4. Load Operating System

After successfully completing the POST, the computer continues to follow the instructions in ROM to load the operating system files. The computer tries to find and load

related files from the default drive. If a message “Non-system disk or disk error” is displayed, it indicates a system file error. If the system file is normal, the CPU will then load the “Command.com” file. If the file is correct, the computer can accept the input command (Figure 2-6).

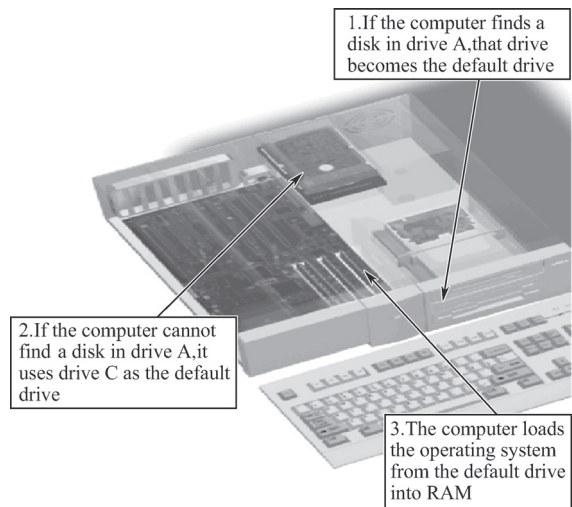


Figure 2-6 Loading the operating system

5. Ready for Accepting Commands and Data

When the boot process is completed, the operating system desktop or prompt will appear. If Windows still doesn’t work, you can start it in safe mode, which can only be used for trouble shooting, not for real computing tasks. After trouble shooting in safe mode, you can use the computer normally.

2.3A

Programming



Computer programming, or programming, is the process of giving a solution to a particular problem and an important step in the software development process. Program design often uses a programming language as a tool to give programs in this language. The

programming process should include different stages such as analysis, design, coding, testing, and debugging.

In the early days of computer technology development, software development was mainly program design. However, with the development of technology, software systems are becoming more and more complex, gradually diversifying into many specialized software systems, such as operating systems, database systems, and application servers, and these specialized software systems are increasingly becoming part of the general system environment. In this case, the content of software development is becoming more and more abundant. It is no longer just pure programming, but also includes database design, user interface design, communication protocol design, and complex system configuration process.

Professional program makers are called programmers. In some sense, the appearance of programming preceded the advent of computers. The daughter of the famous British poet Byron, Ada Lovelace, designed a program for calculating the Bernoulli number on the Babbage analysis machine. She even created the concept of loops and subroutines (Figure 2-7, 2-8). Because of her breakthrough innovations in programming, Ada Lovelace is known as the world's first programmer.







Name	Symbol	Use in Flowchart
Oval		Denotes the beginning or end of the program
Parallelogram		Denotes an input operation
Rectangle		Denotes a process to be carried out e.g. addition, subtraction, division etc.
Diamond		Denotes a decision (or branch) to be made. The program should continue along one of two routes (e.g. IF/THEN/ELSE)
Hybrid		Denotes an output operation
Flow line		Denotes the direction of logic flow in the program

Figure 2-7 Flowchart symbol

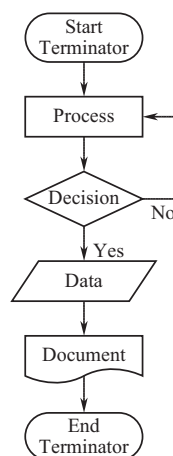


Figure 2-8 Concept of loop

New Words

- programming** ['prəʊgræmɪŋ] n. (计算机) 编程, 程序设计
particular [pə'tɪkjʊlə] adj. 专指的, 特指的 (与泛指相对)
diversify [daɪ'və:sɪfaɪ] vi. 使……多样化, 变化, 与……不同
database ['deɪtəbeɪs] n. 数据库, 资料库
protocol ['prəʊtəkəl] n. 草案, 礼仪, 协议
process ['prɒses] n. 过程, 进程, 步骤, 流程
professional [prə'feʃənl] adj. 职业的, 专业的
calculate ['kælkjuleɪt] vt. 计算, 预测
analysis [ə'næləsis] n. 分析, 分析结果
subroutine ['sʌbruːtɪ:n] n. 子程序
breakthrough ['breɪkθruː] n. 重大进展, 突破
innovation [ˌɪnə'veɪʃən] n. 创造, 创新, 改革

Phrases and Expressions

- give...to...:** 把……给……
in the early days: 在早期, 在初期
operating system: (计算机) 操作系统
be known as...: 被称为……, 被认为是……, 以……而著称

Notes

- (1) However, with the development of technology, software systems are becoming more

and more complex, gradually diversifying into many specialized software systems, such as operating systems, database systems, and application servers, and these specialized software systems are increasingly becoming part of the general system environment.

第 1 个 becoming 为系动词，作为谓语，采用现在进行时。complex 为形容词，作为表语。系动词所连接的表语可以是形容词、名（代）词、数词、副词、介词短语、不定式、动名词、现在分词、过去分词或表语从句。gradually diversifying 为现在分词，作为状语。置于句前或句后，与句子常以逗号隔开，表示伴随的动作。

(2) It is no longer just pure programming, but also includes database design, user interface design, communication protocol design, and complex system configuration process.

communication protocol design 为同位语。同位语紧跟在名词或代词之后，用于补充说明该名词或代词。

(3) Because of her breakthrough innovations in programming, Ada Lovelace is known as the world's first programmer.

known 为谓语，采用一般现在时和被动语态。被动语态的格式为：助动词 be + 过去分词。被动句中动作的承受者为句子的主语。

2.3B



Programming for the Web

The earliest software was run on the mainframe. Software users logged into the mainframe to run the software through a “dumb terminal”. Later, with the rise of the PC, software began to run on the desktop, and software such as database runs on the server side. This Client-Server model is referred to as the CS architecture for short (Figure 2-9).

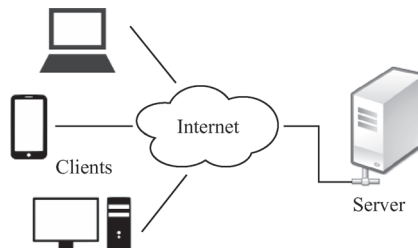


Figure 2-9 The CS architecture

With the rise of the Internet, people found that the CS architecture is not suitable for the

web, mostly because the web application programs are modified and upgraded very quickly. The CS architecture requires each client to upgrade the desktop application one by one. Therefore, the Browser-Server model is becoming popular, referred to as BS architecture.

In the BS architecture, the client only requires a browser, and the logic and data of application programs are stored on the server. The browser only needs to request the server to obtain the information of web page and display the web page to users.

Of course, web pages are extremely interactive. Since web pages are written in HTML which has powerful expressive capabilities, and clients can use the new version without any change after the server is upgraded, therefore, the BS architecture quickly becomes popular.

Today, with the exception of some heavy weight software such as Office, Photoshop, etc., most of the software is provided in the form of web. For example, news, blog, micro-blog and other services provided by Sina are all web applications.

Web application development can be said to be the most important part of current software development. Web development has gone through several stages:

Static web pages: People edit and generate static HTML pages directly by text editors. If you want to modify the content of a web page, you need to edit the HTML source files again. Early Internet web pages were static.

CGI: Static web pages cannot interact with users. For instance, if users fill out a registration form, the static web pages cannot be processed. In order to handle the dynamic data sent by the users, the Common Gateway Interface (CGI) appears, written in C/C++.

ASP/JSP/PHP: Due to the frequent modification of web applications, using C/C++ is not very suitable for web development. Because of the high development efficiency and tight integration with HTML, scripting languages quickly replaced the CGI model. ASP is Microsoft's web development technology that is programmed with VB Script. JSP uses Java to write scripts, while PHP itself is an open source scripting language.

MVC: In order to solve the problem of poor maintainability caused by embedding HTML directly in a scripting language, web applications have also introduced the Model-View-Controller model to simplify web development. ASP has evolved into ASP.Net, JSP and PHP also have a lot of MVC frameworks.

At present, web development technology is still in rapid development, and asynchronous development and new MVVM front-end technologies are emerging in an endless stream. The history of Python is even longer than that of web. Because Python is an interpreted scripting language and has high development efficiency, it is very suitable for web development. Python has hundreds of web development frameworks and many mature template technologies. People select Python to develop web applications not only because of its high development efficiency, but also because of its high running speed.

2.4A



Supercomputers

Supercomputers are the most powerful computers with the highest computing speed and the largest storage capacity. If you compare the speed of an ordinary computer to that of an adult, a supercomputer is running at the speed of a rocket.

Supercomputers play an important role in the field of computational science and are also applied to various computational intensive tasks in various fields. Supercomputers are essential in military field, such as simulating nuclear weapon explosions, nuclear fusion, and cryptographic analysis. As a key element of high-tech development, supercomputers have become a competitive weapon in economy and national defense of all countries in the world. They are of great significance to national security, economic and social development.

In 1976, Cray Inc. launched the world's first supercomputer with a speed of 250 million calculations per second.

In January 2018, Chinese supercomputers, the Sunway TaihuLight and Tianhe-2 (Figure 2-10, 2-11), respectively ranked the crown and runner-up for the fourth time in a row. In addition, in the supercomputer top 500 list, China overtook the United States again and won the first.



Figure 2-10 Chinese supercomputer: the Sunway TaihuLight



Figure 2-11 Chinese supercomputer: the Tianhe-2

Supercomputers are known as the Economic Transformation and Scientific Research Accelerator. The extensive application of supercomputers can promote the enhancement of the country's overall scientific and technological innovation ability and is an important symbol of the technological development and the comprehensive national strength.

New Words

supercomputer ['su:pəkəmpju:tə(r)] n. 超级计算机, 巨型计算机

rocket ['rɒkɪt] n. 火箭; 芝麻菜

vi. 飞快地移动; 急速上升

vt. 用火箭运送

cryptographic ['kriptəʊ'græfɪk] adj. 关于暗号的, 用密码写的

respectively [rɪ'spektɪvli] adv. 各自地; 各个地; 分别地

overtake [ˌəʊvə'teɪk] vt. 压倒; 追上, 赶上; (不愉快的事) 突然降临

accelerator [æk'seləreɪtə(r)] n. 加速器

extensive [ɪk'stensɪv] adj. 广阔的，广大的；范围广泛的

enhancement [ɪn'hənsmənt] n. 增强；提高；增加；改善

innovation [ˌɪnə'veɪʃn] n. 改革，创新；新观念；新发明；新设施

symbol ['sɪmbəl] n. 符号；象征；标志；记号

vt. 用符号代表

technological [ˌteknə'lɒdʒɪkl] adj. 技术上的；工艺（学）的

comprehensive [ˌkɒmprɪ'hensɪv] adj. 综合的；有理解力的，悟性好的

Phrases and Expressions

at the speed of: 以……的速度

in the field of: 在……方面，在……领域

be of great significance: 意义重大

in addition: 另外；并且；除此之外；况且

be the symbol of: 成为……的象征

Notes

(1) As a key element of high-tech development, supercomputers have become a competitive weapon in economy and national defense of all countries in the world.

a competitive weapon → 一个竞争性武器 → a 可以不翻译出来 → 竞争的利器；

national defense → 国防；

in economy and national defense of all countries in the world → 在经济和国防方面各国的 → 世界各国经济和国防方面。

(2) In January 2018, Chinese supercomputers the Sunway TaihuLight and Tianhe-2 respectively ranked the crown and runner-up for the fourth time in a row.

the crown and runner-up → 冠军和亚军 → 冠亚军；

in a row → 连续；

respectively ranked the crown and runner-up for the fourth time in a row → 分别连续第四次成为冠亚军。

(3) The extensive application of supercomputers can promote the enhancement of the country's overall scientific and technological innovation ability and is an important symbol of the technological development and the comprehensive national strength.

句中有三个 and → 第 1 个 and 连接两个并列成分：scientific 和 technological → 第 2 个 and 连接两个并列成分：can promote the enhancement of the country's overall scientific and technological innovation ability 和 is an important symbol，这是两个谓语的并列。

第 2 个 and 前面省略了主语部分 “The extensive application of supercomputers” → 第 3 个 and 连接两个并列成分: the technological development 和 the comprehensive national strength。

2.4B



CPU and Memory

The central processing unit (CPU) is a very large-scale integrated circuit consisting of tens of billions of electronic components, which is the “brain” of a computer. The central processing unit has two main parts: the arithmetic logic unit and the control unit (Figure 2-12).



Figure 2-12 Intel Core i9 Processor

The ALU (arithmetic logic unit) is responsible for the numerical operation of the input memory data, and returning the result of the operation to the memory to be saved.

The control unit is responsible for continuously extracting instructions from memory. The control unit interprets instructions and identifies tasks to be completed. According to its explanation, the data to be calculated can be obtained from memory and sent to the arithmetic logic unit for operation.

Both the CPU's arithmetic logic unit and the control unit are very important. Computers with advanced arithmetic logic units are powerful, but without the control unit, even a powerful computer can only be a “crazy” “uncontrolled” computer.

Memory (Figure 2-13) is the “memory center” in a computer. Any instructions and data that you want to send to CPU(brain) for processing must be queued in memory and the results of all kinds of data processed by CPU usually need to be sent to memory first. It is then distributed to other parts in computer that require them. There are two main indicators of memory's quality: one is speed, the faster the better; the other is capacity. Only large enough

storage space can support more powerful computer operation.



Figure 2-13 Memory

External memory, which is corresponding to memory, generally includes hard disk, optical disk, floppy disk (Figure 2-14), USB disk and so on. The programs we usually use, such as Windows operating system, typing software, game software, etc., are generally installed on hard disk and other external memory. Programs stored on external memory cannot be executed directly by CPU. They must be transferred into memory and delivered to CPU in an orderly manner before their functions can really be used. Usually inputting a paragraph of text or playing a game is executed in memory in fact. Just like in a study, the bookshelf and the bookcase are equivalent to the external memory of the computer, and the desk is the memory. Usually we store a large amount of data that needs to be permanently stored in external memory, and some temporary or small amount of data and programs are stored in memory. Therefore, the speed and capacity of memory will directly affect the working speed of the computer.



Figure 2-14 Floppy disk

Unit 3

Information Safety

3.1



Kevin Mitnick

Kevin Mitnick is known as a world-famous computer hacker. His hacking story is legendary enough to shock the world and discredit most of cyber security personnel.

In 1977, Mitnick, a 13-year-old pupil, became a computer genius who marveled his teachers until he was expelled from school after he casually broke into the network of other schools. Mitnick, at the age of 15, then broke into the computer mainframe of the North American Air Defense Command System. He and some of his friends rummaged through data on all U.S. nuclear warheads pointing to the former Soviet Union and its allies, and then quietly slipped out.

The Pentagon has been silent on the matter. “If Mitnick were to sell the intelligence to the KGB, he would be rewarded at least \$500000, while the United States would spend billions of dollars to redeploy.” Crichton, a prominent US military intelligence expert, said afterwards.

FBI thought him was too dangerous, so they bought off one of Mitnik’s best friends and tempted him to attack the site again in order to catch him. Mitnick took the bait, but he discovered the trap after breaking through the FBI’s intranet and began a legendary manhunt and counter-hunt with FBI. In the process of escaping, he took control of the relevant network by means of excellent hacking techniques, where he flipped through his case files and mercilessly mocked the police who had pursued him. Each time he saw the arrest order earlier than the police, so he could easily play hide-and-seek with the police and finally he was arrested by the latest “computer network information tracker”.

Although he was only a teenager, he was known as a “little boy lost in the cyber world” because of his constant cybercrime. When he was arrested at last, the police even banned him

from touching the semiconductor radio on the ground that “any electronic product in his hands would be his weapon.”

Cruising the Pentagon, logging into the Kremlin, accessing all the computer systems around the world——this was Mitnick in his boyhood. Now Mitnick is a network security consultant, who has published *The Art of Anti-deception*, *The Art of Anti-invasion*, *Ghost in the Wires: My Adventures as the World's Most Wanted Hacker* (Figure 3-1) and other famous works and has become a champion of network security.

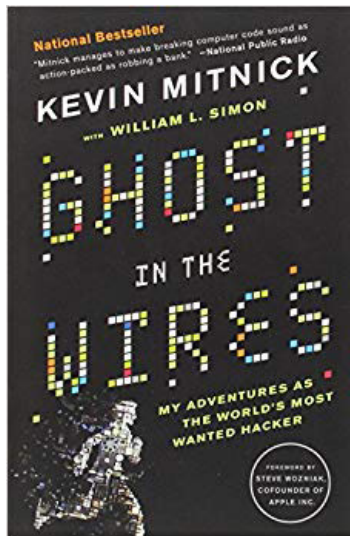


Figure 3-1 Works of Kevin Mitnick

3.2

The Grand Microworld——Chips



A chip is like the pearl at the top of the global manufacturing industry crown. Its design and manufacturing capability is a symbol of a country's comprehensive strength. Figure 3-2 below is a picture of the appearance of a computer chip, and Figure 3-3 is a complex structure inside a chip.

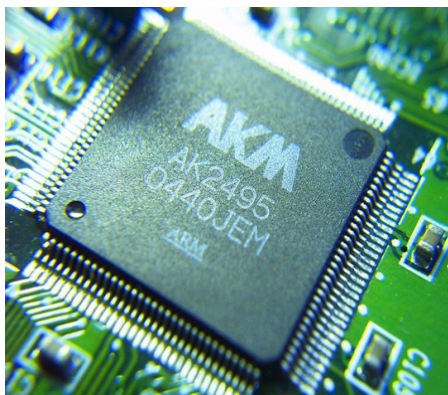


Figure 3-2 The appearance of a chip

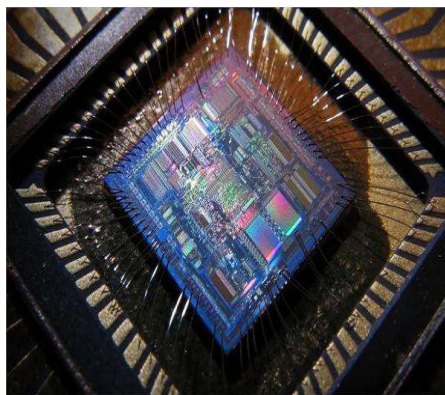


Figure 3-3 The internal structure of a chip

Only “complex” is not enough to describe a chip’s level of integration. The appropriate adjective should be “grand” because the inside of a chip is no longer a flat plane we see with naked eyes, but a nano-scale three-dimensional structure. What is the concept of nanometer? Look at your fingernails and divide the thickness of them evenly into 100,000 parts, one of which is about 1 nanometer. Each of the numerous electronic components inside a chip is several nanometers in size.

Why does the manufacturing capability of a single chip represent the overall strength of a country? It is because its manufacturing difficulty is equivalent to the building of hundreds of Beijing-city buildings on the nail-sized silicon chip. It’s not just in a similar structure but also ensures everything is working well including water, electricity, gas, vehicles and so on. It is far more difficult than the construction of several cities or even the project of “Two Bombs and One Satellite”.

New Words

- design** [dɪ'zain] n. 设计；绘制；计划
- manufacturing** [ˌmænju'fæktʃərɪŋ] n. 制造业，工业
- enough** [ɪ'nʌf] adj. 足够的
- describe** [dɪ'skraɪb] vt. 叙述；描写，描述
- chip** [tʃɪp] n. 芯片；（作为赌注用的）筹码
- adjective** ['ædʒɪktɪv] n. 形容词
adj. 形容词的；附属的
- grand** [grænd] adj. 宏大的，宏伟的
- electronic** [ɪˌlek'trɒnɪk] adj. 电子的；以电子方式操纵的
- component** [kəm'pəʊnənt] n. 成分；组件；元件；零件

Phrases and Expressions

- comprehensive strength:** 综合实力
- naked eye:** 裸眼→肉眼
- no longer:** 不再，已不
- be equivalent to:** 与……相等→相当于

Notes

(1) The appropriate adjective should be “grand” because the inside of a chip is no longer a flat plane we see with naked eyes, but a nano-scale three-dimensional structure.

we see with naked eyes 为省略了引导词 that 的限制性定语从句，修饰 a flat plane。完整的应该是：a flat plane that we see with naked eyes → 我们用肉眼所见的扁平平面。

(2) It is because its manufacturing difficulty is equivalent to the building of hundreds of Beijing-city buildings on the nail-sized silicon chip.

It is because 中 because 引导表示原因的表语从句：它是因为……→这是因为……
on the nail-sized silicon chip → 在指甲盖大小的硅片上。

(3) It's not just in a similar structure but also ensures everything is working well including water, electricity, gas, vehicles and so on.

everything is working well including water, electricity, gas, vehicles and so on 为省略引导词 that 的宾语从句 → 水、电、气、交通工具等全部正常运转。

3.3A



Worm Virus

A worm virus is a highly explosive computer virus. It copies itself and spreads throughout the network. It has many ways of transmission and does great harm. “Panda Burning Incense” and its varieties, widely spread in January 2007, are examples of worm viruses.

Worm virus first appeared in 1988. Robert Tappan Morris, a graduate student at Cornell University in America, wrote a computer program to verify the idea that programs can reproduce themselves. He had planned for it to reproduce only once. However, it reproduced unlimitedly because of a wrong counter. As a result, one tenth of the world’s web servers were completely paralyzed and other systems just crawled to a snail’s pace, which caused more than ten billion dollars loss. The worm virus is thus present in the network.

The birth of the worms marked the beginning of the dark age of the Internet. As others have written countless, more powerful programs based on the principles of the worms and inserted malicious modules —— the “computer viruses”.

Can a thing that is able to reproduce itself be defined as a primitive life form? If so, this means that there were lives in the virtual world a few decades after the birth of the computer. In contrast, the earth was born billions of years before life appeared. Can you think about how

long it will be before the virtual intelligent life appears?

New Words

explosive [ɪk'spləʊsɪv] adj. 爆炸的；易爆炸的；爆发的

transmission [træns'mɪʃn] n. 传送；播送；（电台或电视）信息；传动装置

harm [hɑ:m] n. 危害；伤害；损害

vt. 危害；伤害；损害

burning ['bɜ:nɪŋ] adj. 燃烧的；发热的；急切的

incense ['ɪnsens] n. 香；焚香时的烟；奉承

vt. 使……愤怒；激怒

verify ['verɪfaɪ] vt. 核实；证明；判定

reproduce [ˌri:prə'dju:s] vt.& vi. 复制，重现

plann [plæn] vt. 计划，打算

unlimitedly [ʌn'limitɪdli] adv. 无限地，无例外地

Phrases and Expressions

many ways: 很多方面；许多方法；许多方式

Panda Burning Incense: 熊猫烧香

Cornell University: 康奈尔大学

as a result: 结果，因此

Notes

(1) “Panda Burning Incense” and its varieties, widely spread in January 2007, are also worm viruses.

整句话为“主系表”结构。主语是“Panda Burning Incense” and its varieties，系动词是 are，表语是 worm viruses。widely spread in January 2007 为后置定语。

(2) Robert Tappan Morris, a graduate student at Cornell University in America, wrote a computer program to verify the idea that programs can reproduce themselves.

Robert Tappan Morris, a graduate student at Cornell University in America → a graduate student at Cornell University in America 是同位语，补充说明 Robert Tappan Morris 的身份。→ 整个句子的主语是 Robert Tappen Morris，谓语是 wrote，宾语是 a computer program。

(3) to verify the idea → 不定式作为目的状语 → 为了验证那个想法。

(4) programs can reproduce themselves → 程序可以复制自己 → 程序可以自我复制。

(5) the idea that programs can reproduce themselves → that 引导的是一个同位语从句，that 作为关系副词没有意义，但是不能省 → “程序可以自我复制”的想法。

(6) One tenth of the world's web servers were completely paralyzed and other systems just crawled to a snail's pace, which caused more than ten billion dollars loss.

which caused... loss → 它造成了……损失。

ten billion → 十个十亿 → 百亿。

and 连接的两个并列成分是两个句子，一个是 One tenth of the world's web servers were completely paralyzed, 另一个是 other systems just crawled to a snail's pace。

which caused more than ten billion dollars loss → which 引导非限制性定语从句，which 指代前面的整个句子。

3.3B



Wang Xiaoyun—a Chinese Scientist Who Defeated the Cryptographic Algorithms

Cryptography is the cornerstone of information security, and a password is the key to protecting users' information. So who's going to protect the password? That is the algorithms (Figure 3-4). Since “algorithms” are so important, can each country develop a set of its own “secret algorithms” that will never leak out to achieve information security? The answer is no!



Figure 3-4 The core of cryptography is the algorithm

For example, one country lost a number of important passwords which just needed to be replaced to avoid an expansion of loss; but if a “secret algorithm” is leaked, all the software

should be replaced nationwide. So the core of the encryption algorithm is not “secret”, but “solid”——“I tell you exactly what my encryption algorithm is, but you just can’t crack it!”

Wang Xiaoyun is a female professor at Shandong University and a Chinese cryptologist. In 2004, her team successfully cracked four internationally famous cryptographic algorithms: MD5, HAVAL-128, MD4, and RIPEMD. A few months later, she deciphered the more difficult SHA-1. SHA-1 cryptographic algorithm, designed by the National Institute of Standards and Technology and the National Security Agency, a institution that specializes in cryptographic algorithms in the United States, is recommended for adoption by the United States government and the financial system as early as 1994, it is one of the most widely used cryptographic algorithms in the United States government. MD5 is one of the cornerstones of international “electronic signature” technology. The status of “electronic signature” is equivalent to the “fingerprint” of individuals on the Internet, and is widely used in the field of electronic commerce, such as finance, securities and so on. Experts had argued that the MD5 algorithm could guarantee that digital signatures were not able to be forged. But soon afterwards Wang’s team developed a method that can quickly match these digital “fingerprints”, much to surprise the international peers.

There are experts who used sensational articles such as *Crash! The Crisis of Cryptography* to depict Wang’s landmark achievements in the United States *New Scientist* magazine. Because of Wang’s work, the National Institute of Standards and Technology announced that the US government would stop using the SHA-1 in five years and replace it with more advanced new algorithms, and well-known companies such as Microsoft, Sun and Atmel have also published their own countermeasures.

Maybe some people think that the woman, who once made the digital world almost impossible for secure algorithms, must have had a very bitter and tiring life. But she said: “During that time, while I was holding my child and doing housework, the possible path to cracking a variety of algorithms was hovering in my head. I worked hard for some time and took a rest when I felt tired. I still miss those ten years of life. ”Look, life can be so beautiful when hobbies are integrated with work!

3.4A

Hacker and Cracker



Hackers refer to people who use technology to enter computer systems and network

systems beyond their authority. The hacker attacks system in full legal condition, remind the system owner that the system has security bugs, and urge the system developer to gradually improve the procedure. They are also known as “white hat hackers” or “sneakers”.

The “white hat hackers” have the ability to break through the limits and the spirit of opening and sharing; freedom is their ideal. The Internet world they dream of is a free world without conflicts of interest and money trading, but with full sharing. They built Internet and UNIX operating systems; they set up Usenet to make WWW work properly.

“Crackers” stand for people trying maliciously (or illegally) to crack or destroy a program, system and network security. They load and intrude into systems for destructive purposes without any permission, so they are also called “black hat hackers”.

Crackers use their own programs to find security bugs in others’ computer systems, and use these bugs to destroy websites, illegally steal information, carry out extortion, and so on. They are skilled in deciphering software passwords and producing pirated software, and they do make great “contribution” to rampant software piracy in some countries.

A real hacker is not a destroyer in the Internet age, but a watcher. Hackers are constructive, while crackers are sabotaging.

New Words

- hacker** ['hækə] n. (计算机) 黑客; 计算机迷
- cracker** ['krækə] n. 爆竹; 薄脆饼干; 迷人的姑娘; 解密高手; 骇客
- bug** [bʌg] n. 昆虫; 缺陷, 瑕疵; 细菌, 病菌; 窃听器
- conflict** ['kɒnflɪkt] n. 冲突; 矛盾; 战斗; 相互干扰
- maliciously** [mə'liʃəsli] adv. 有敌意地
- intrude** [ɪn'trud] vi. 闯入; 打扰; 侵入, 侵扰, 打扰
vt. 把观点强加于他人; [地质] 侵入其他地层; 硬挤
- extortion** [ɪk'stɔːʃən] n. 敲诈, 勒索; 被勒索的财物; 敲诈者
- decipher** [dɪ'saɪfə] vt. 解读; 破译(密码); 辨认(潦草字迹)
- rampant** ['ræmpənt] adj. 猖獗的; 蔓延的
- sabotage** ['sæbəʊtɑːʒ] v. 蓄意破坏; 怠工; 对……采取破坏行动

Phrases and Expressions

- beyond their authority:** 超出他们(应有)的权限
- the spirit of opening and sharing:** 开放和共享的精神
- Unix operating systems:** Unix 操作系统
- deciphering software passwords:** 破译软件密码

Notes

(1) The Internet world they dream of is a free world without conflicts of interest and money trading, but with full sharing.

they dream of → 他们梦想的, 作为定语从句修饰前面的 world; 从 without 到 sharing 是两个并列的介词短语, 作为定语成分, 分别由 without 和 with 引导 → 修饰前面的 free world → 没有利益冲突、没有金钱交易、完全共享的自由世界。

(2) “Crackers” stand for people trying maliciously (or illegally) to crack or destroy a program, system and network security.

主语为 Crackers, 谓语为 stand for, 宾语为 people → 整个句子的主结构为: Crackers stand for people. trying 后面的整个结构是“动词-ing”形式的分词短语作为后置定语修饰 people。

(3) They load and intrude into systems for destructive purposes without any permission, so they are also called “black hat hackers”.

into the other systems → 进入对方的系统。

for destructive purposes → 为了破坏性的目的。

without any permission → 未经任何许可。

so they are also called “black hat hackers” → 他们亦被称为“黑帽黑客” → 此时的 so 是一个逻辑连词，可以不译。

3.4B



Hacker Events of Great Influence in History

The virtual network world is intricate and dangerous, and a little inadvertence action can even cause more terrible damage than that of in reality. Let's learn about the hacker attacks of great influence in history.

1. The logic bomb exploded in Siberia

In 1982, the Reagan administration's FBI discovered that the KGB had stolen information from the West for many years. In this regard, the CIA decided to set a huge trap for the KGB. They deliberately leaked a “confidential software”, and CIA used the Trojan virus to plant “logical bombs” in the software. The logic bomb will start after the software switched to a 100,000 cycle run in a different mode. The KGB examined what they had stolen carefully and found nothing unusual. Moreover, the software is very helpful for them, and can be used in the construction of natural gas pipeline projects extending to Western Europe from Siberia. The program worked very well in the first few months, but in June 1982, American spy satellites detected a very big explosion at the Siberia pipeline construction site. The power of the explosion was 30 thousand tons of TNT, about one fifth of the atomic bomb exploded in Hiroshima. At that time, the internal magazine of US described it as “the greatest non-nuclear weapon explosion seen from space”.

2. Invading the banking system for a huge amount of money

In 1995, Vladimir Levin, a Russian hacker, played a wonderful magic on the Internet. He was the first hacker in history to make a profit by invading the bank computer system. He invaded the system of Citibank in the United States and stole ten million dollars. He was arrested in Britain by Interpol in 1995.

3. “Baidu” is hacked

At 7 o'clock a.m. on January 12th, 2010, Baidu, the world's largest Chinese search

engine, was attacked by hackers and unable to be visited regularly for a long time. It covered most provinces and cities such as Sichuan, Fujian, Jiangsu, Jilin, Zhejiang, Beijing and Guangdong, etc. This was the longest and most serious hacker attack since Baidu had been established. When Internet users visited Baidu, it would be directed to an IP address in Holland, and all the subdomains of Baidu could not be accessed normally.

4. Bitcoin extortion virus

On May 12th, 2017, WannaCry worm virus erupted around the world through MS17-010 vulnerabilities and infected a large number of computers. The worm infected computers and implanted blackmail virus to them, causing the computers to encrypt a large number of files. After the victim's computer was locked by hackers, the virus would prompt a payment of bitcoin equivalent to \$300 (about 2,069 Yuan at that time) to unlock those files. WannaCry extortion virus globally broke out, influencing at least 300 thousand users in 150 countries, resulting in a total loss of 8 billion dollars, affecting the finance, energy, health care and other industries. Some users of Windows operating system had been affected in China. Users of campus network bore the brunt. A large number of laboratory data and graduate theses were locked and encrypted.

5. Attacks on Russian websites

On April 9th, 2018, an unknown hacker group gained the ability to execute arbitrary code of network devices by using the bugs in CISCO's smart installation program. The criminals changed the image of the CISCO Internet operating system and rewrote the configuration files, and the attack resulted in the overall break-down of the data center. There were signs that the criminals mainly attacked the Russian domain, but other countries were obviously not excluded (Figure 3-5).

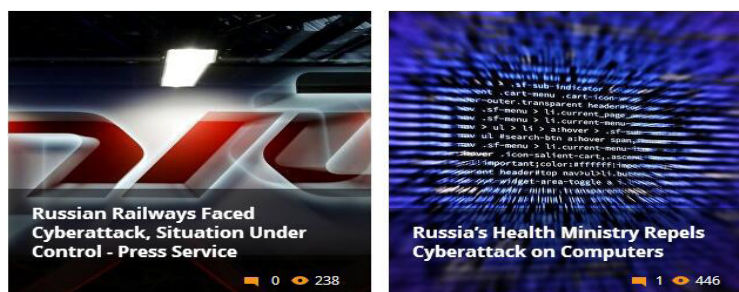


Figure 3-5 Attacks on important Russian departments

Thus it can be seen that the virtual world is also amazing. We should be in awe of the Internet world. While the devil climbs a post, the priest climbs ten. We believe that justice will ultimately prevail over evil.

Unit 4

Electrical Safety

4.1



Banking Upheaval——the World's First Self-service Bank

On April 10th, 2018, the first domestic, also the world's first self-service bank, China Construction Bank, Shanghai Jiujiang Road branch, was officially opened in Shanghai (Figure 4-1).



Figure 4-1 Entrance of self-service bank

The moment you step into the bank, you will be shocked: you can find no security guards, but a face recognition gate and sharp cameras.

You won't find a lobby manager. Instead, you will find robots who smile and talk to you, even asks whether you are fine (Figure 4-2).

And you can't even find a bank teller. Instead, you can find a more efficient smart teller machine that understands what you want.

The first operation requires the binding of mobile phone number (Figure 4-3), bank card and face recognition. After that, you can withdraw money by entering your mobile phone

number and conducting a facial scan, which is convenient and quick. There are no clerks in the bank, but more than 90 percent of cash and cashless service can be handled. For complicated operation, just wear your headphones and glasses and go one-on-one remotely.



Figure 4-2 Robots in self-service bank



Figure 4-3 Facial identification

The “self-service bank” is not just a bank; it plays multiple roles. It is a “library” with 50,000 books, which can be saved and taken away with a swipe of a mobile phone; it is a “shopping hall” that implements many technologies of AR and VR, and you can see all the houses for renting in the APP of CCB; it is also a “small supermarket”, from which you can get free drinks on the smart vending machine and the robot takes photos automatically, after you handle the relevant financial business.

The banking upheaval has never been as fierce as it is today! Not only are there no clerks in bank branches, but also there is an earthshaking change on the function of bank branches.

It is foreseeable that in the future, there may retain only a few traditional branches with clerks in a city, and the rest will be all such self-service banks (Figure 4-4).

Some people are worried that the elders don’t know how to operate. CCB has introduced

that self-service bank and intelligentization of bank branches free more people from the stylized position to centralize the resource and provide personalized services to the customers and provide more detailed professional services for the elders and other special groups.

“Driverless” “unmanned supermarket” and “self-service convenience store” have become popular, and technological companies and Internet companies have entered the market one after another. Though at present these “unmanned” scenes are not perfect, China’s unmanned market will become more and more abundant with the continuous development of science and technology.



Figure 4-4 A customer is applying self-service businesses

The appearance of the “self-service bank” has fully demonstrated that the CCB uses the latest financial intelligence science and technology achievements, such as the biological identification, voice recognition, data mining, and integrates the current popular technologies such as robot, VR, AR, face recognition, voice navigation, holographic projection.

4.2A

Safety Signs



In our work and daily life, safety signs should be displayed in accordance with safety regulations at corresponding places or areas.

1. Prohibition Warning Signs (Figure 4-5)

Prohibition warning signs forbid or prevent people's certain actions. The geometric figure is a red ring with a slash; the graphic symbol is black and the background is white.



Figure 4-5 Prohibition Warning Signs

2. Warning Signs (Figure 4-6)

Warning signs are used to warn people of possible dangers. The geometric figure is a black regular triangle with a black symbol, and the background is yellow. The letters added below the triangle are marked in black with a white background.

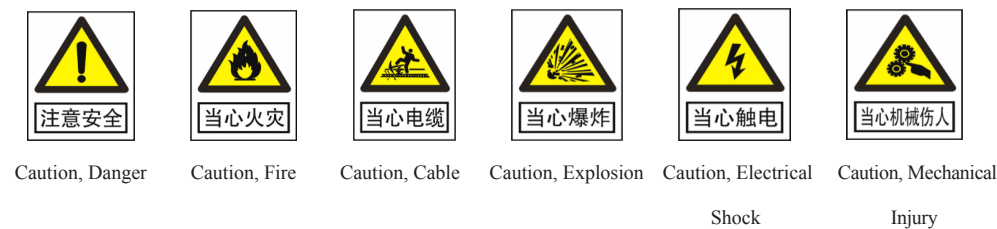


Figure 4-6

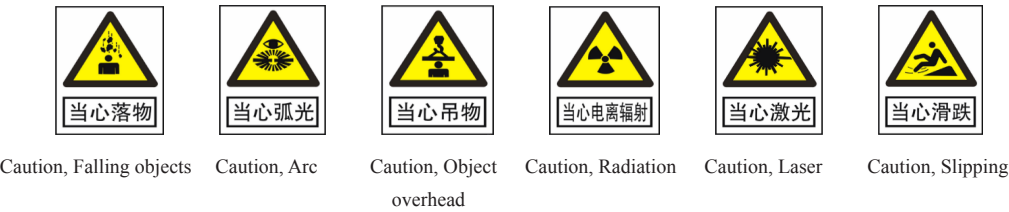


Figure 4-6 Warning Signs (continue)

3. Instructional Signs (Figure 4-7)

Instructional signs mean rules that must be followed. The geometric figure is round, with a blue background and a white graphic symbol.



Figure 4-7 Instructional Signs

4. Tip Signs (Figure 4-8)

A tip sign indicates the direction of the target. The geometric figure is square, with a green or red background and with white graphic symbols or letters.



Figure 4-8 Tip signs

New Words

accordance [ə'kɔ:dns] n. 一致；和谐；给予

regulation [ˌregju'leɪʃn] n. 规则；管理；控制；规章

adj. 规定的

corresponding [ˌkɒrə'spɒndɪŋ] adj. 相当的，对应的

v. 相符合

prohibition [ˌprəʊhɪ'bɪʃn] n. 禁令

prevent [prɪ'vent] vt. 预防；阻止

geometric [ˌdʒi:ə'metɪk] adj. 几何学的

instructional [ɪn'strʌkʃnl] adj. 指导的

indicate ['ɪndɪkeɪt] vt. 表明，标示，指示

Phrases and Expressions

warning sign: 警示标志

regular triangle: 正三角形

instructional sign: 指示标志

graphic symbol: 图形符号

Notes

(1) In our work and daily life, warning signs should be displayed in accordance with safety regulations at corresponding places or areas.

in accordance with → 按照。

safety regulations → 安全规范。

at corresponding places or areas → 在相应地点或范围内。

(2) The geometric figure is a red ring with a slash; the graphic symbol is black and the background is white.

geometric figure → 几何图形。

with a slash → 带斜杠的。

4.2B



Common Senses of Household Electricity Safety

Modern family cannot live without electricity. We should learn the common sense of household electricity safety, raise the awareness of electrical shock prevention, and protect the safety of life and property. Here is some common knowledge about the safety of household electricity:

(1) Know the power switch (Figure 4-9) and learn to turn off the power supply in case of emergency.

(2) Do not overload power. The total current in household electrical equipment must not exceed the maximum rated current of the watt hour meter and the power line.

(3) Install the protector. The dual functional protector of over voltage tripping and leakage tripping must be installed in using household electricity, such as the frequently-used air switch which can switch off the power automatically in case of electric appliance leaks or personal electric shock, or when the supply voltage is too high or too low.

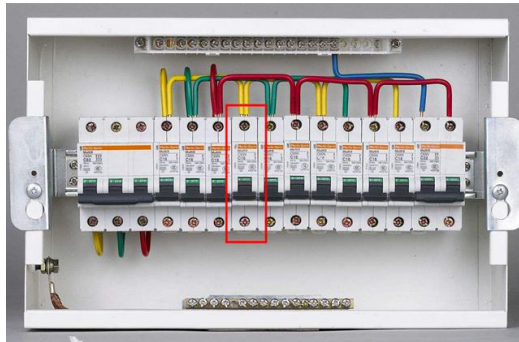


Figure 4-9 Power switch

(4) Qualified products should be one's option to select household electrical equipment. Do not buy counterfeit products for their cheaper prices.

(5) Do not forget to install grounding wires for three-phase sockets; do not change three-phase plugs into two-phase plugs at will.

(6) Develop good habits: power off when leaving house, during a power failure, before maintenance checks and before going to bed; unplug when electrical appliances are not in use.

(7) Do not touch the electrical appliances with wet hands. Do not wipe the appliances with wet cloth.

(8) Residential power socket should be safe socket, and in order to prevent electric shock and ensure the safety of young children, anti-splash socket should be used in bathrooms and other wet places.

(9) When installing household electric appliances, attention should be paid to the using environment of electrical appliances. Do not install household appliances in damp, heated, dusty, flammable and corrosively-gases situation.

(10) Always pay more attention to household appliances, plugs, sockets, and so on. If there is any aging phenomenon, timely replacement should be applied.

(11) When electrical appliances are damaged, please ask professionals to repair them. Never disassemble and assemble them on your own.

(12) It is strictly prohibited to use substitutes. Copper wire, aluminium wire and iron wire can't be used to replace fuse. Signal transmission line can't be used instead of power cord. Also don't use medical white rubber cloth instead of insulating black rubber cloth.

(13) Don't move the household electrical appliances in operation. Disconnect the power when you have to move them.

(14) It is strictly forbidden to connect from the public line without permission.

(15) In case of thunderstorm, turn off electrical appliances in time to prevent electric shocks from hurting people or damaging electrical appliances.

(16) Parents should teach children that they can't play with electrical appliances.

(17) Household electric heating equipments and heating units must be kept away from gas tanks and gas pipes. When gas is leaking, windows should be opened first, and do not push the power switch. Ask professionals to repair the leaking.

(18) Electric hair drier, electric cooker, electric iron, electric heater and other electric appliances will give off high heat in use, so please keep them away from paper, cotton and other flammable materials to prevent the outbreak of fire. Avoid scalding when using, cut off the power after use, and unplug the power plug to prevent accidents.

(19) If household appliances are smoking, burning, catching a fire, or having abnormal sound, the power must be cut off immediately, and then check the problems or put out the fire. Do not just water or foam extinguisher to spray (Figure 4-10).

(20) If someone is found to have gotten an electric shock, the power should be disconnected first. Do not save lives with electricity on.

Only after mastering common senses of household electricity safety and learning to use all kinds of electric appliances correctly, can we avoid accidents and reach the goal of using electricity safely to ensure safety.



Figure 4-10 Power-off first and then put out the fire in case of electrical fire

4.3A

First Aid for Electric Shock



In case of an electric shock accident, call 120 for first aid immediately and decide whether to call 119 upon the situation (Figure 4-11).

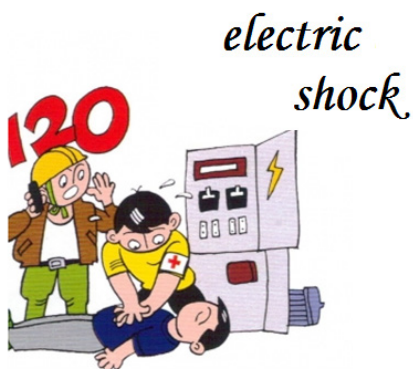


Figure 4-11 Dialing the emergency number 120

After the electric-shock accident occurs, the rescue of the injured must be done against clock. The first step of electric-shock rescue is to cut off the power source to the electric-shock

person quickly. The second step is the on-spot rescue.

When a low voltage shock occurs, the power should be cut off immediately, and then remove the injured to proceed the on-spot aid. Please use insulating tools to cut the power off so as to prevent the rescuer from getting an electric shock.

When a high-voltage shock occurs, the rescuer needs to do the insulation work before getting close to rescue.

When the injured is out of dangerous environment, he should be lied on his back, and should not be moved around. Unlock his clothes and belt quickly. Make sure the surrounding air is not blocked, and call 120 for first aid at the same time. After doing the above, the corresponding rescue can be done. If the injured has no breath but with heartbeats, the artificial respiration can be carried out; if the injured has breath but without heartbeats, chest compression can be carried out until the heart beats are regained (Figure 4-12).

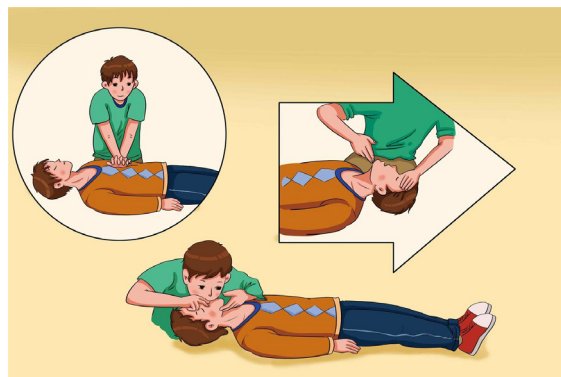


Figure 4-12 First aid for electric shock

When we do the first aid, it is necessary to ensure the safety of the rescuer first before rescuing others.

New Words

- shock** [ʃɒk] vt. 使休克；使震惊；使受电击
situation [ˌsɪtju'eɪʃn] n. (人的) 情况；局面；形势
spot [spɒt] n. 地点
 adj. 现场的
voltage ['vɒltɪdʒ] n. 电压，伏特数
insulating ['ɪnsjuleɪtɪŋ] adj. 绝缘的
prevent [prɪ'vent] vt. 预防；阻止
insulation [ˌɪnsju'leɪʃn] n. 绝缘；隔声；隔离
belt [belt] n. 腰带；传送带；带状物
heartbeat ['hɑ:tbi:t] n. 心跳
artificial [ˌɑ:tɪ'fiʃl] adj. 人工的；人造的
respiration [ˌrespə'reɪʃn] n. 呼吸，一次呼吸
compression [kəm'preʃn] n. 压缩，压紧

Phrases and Expressions

- electric-shock accident:** 触电事故
against clock: 分秒必争
on-the-spot: 现场
insulating tool: 绝缘工具
artificial respiration: 人工呼吸
chest compression: 胸外按压

Notes

(1) The first step of electric-shock rescue is to cut off the power source to the electric-shock person quickly.

此句中 to cut off 为不定式短语，作为 is 的表语；to the electric-shock person quickly 中 to 是介词，后跟名词短语。

(2) If the injured has no breath but with heartbeats, the artificial respiration can be carried out.

此句中 If 引导的为条件状语从句，注意被动语态的翻译方法。

(3) When we do the first aid, it is necessary to ensure the safety of the rescuer first before rescuing others.

此句中 it 为形式主语，不定式 to ensure 引导的短语是句子真正的主语。

4.3B



Common Measures for Household Electric Fire Prevention

Electric fire generally refers to the fire caused by thermal energy released due to failure of electric lines, electric equipments, appliances and distribution equipments: such as the energy release of high temperature, electric arc, electric spark and non-fault; or the hot surface of electric heating appliances, igniting a body or other combustible substance under conditions of combustion. It also includes a fire caused by lightning and static electricity.

The direct causes of household electric fire are various, such as overload, short circuit, poor contact, improper grounding and improper use of electric appliances. Household electric fire does not only seriously affects people's production, life and work, but also directly threatens the safety of human life.

So, what are the common measures for household electric fire prevention?

(1) When purchasing household appliances, buy qualified products produced by regular manufacturers. Operate correctly according to the instructions when using. Always check household appliances and their lines. If finding any fault, repair it timely.

(2) Don't use copper, lead, iron to take the place of fuse. Don't use too many high-power electric equipments at the same time (Figure 4-13).

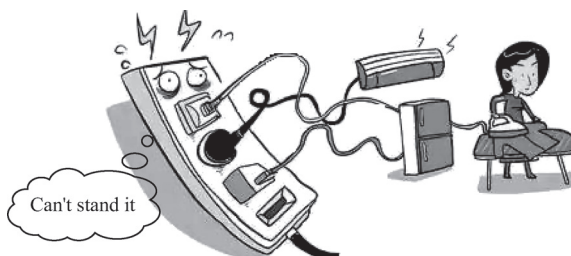


Figure 4-13 Do not put too many plugs into a socket

(3) Don't randomly connect and pull the power wire. Don't lay the wire directly on the flammable material. Electric wiring should be firmly connected, preventing loosening or poor contact.

(4) Correctly use electric heating appliances. When using an electric iron, do not iron it on clothing for a long time. When you do not use it for a while, put it on one side or on a special metal rack and remove the plug immediately when you leave.

(5) The electric blanket should be laid on a flat bed, not on a soft mattress, in case the concave-convex bed surface break resistance wires. It is strictly forbidden to charge in the case of curl and folding.

(6) When using rice cooker, keep the bottom of the inner tank and the electric heating board clean. Do not attach water spots, dust, rice grains, sundries, etc.

(7) It is strictly prohibited to store flammable and volatile chemical reagents and medicines in the refrigerator to avoid the formation of mixed gases with air after volatilization and catching fire by electric spark explosion.

(8) When washing machine is working, it cannot be overloaded, lest the motor overload heat and generating high temperature.

(9) If the power of electric equipment is cut off due to power failure or other reasons, it should be delayed for 3-6 minutes before reopening.

(10) If you smell the stink of gas or liquefied gas in home, it indicates the leaking of gas or liquefied gas, you can't turn on the light or use other electric equipment at that time. You should first gently open the window so as to avoid sparking by poor contact to cause gas or liquid gas explosion.

(11) In case of electric fire, the power plug should be unplugged, and the dry powder fire extinguisher can be used to extinguish the fire. When there is no fire extinguisher, you can use a wet quilt or a cotton blanket to cover the electric appliances to isolate the air and suffocate the fire. When the power supply is not cut off, it must not be poured with water, in order to avoid the electric short-circuit to expand the fire, or the electric shock accident of firefighters (Figure 4-14).

(12) Cut off the power supply of household appliances such as TV, electric blanket, electric fan, etc. before sleeping or when there is no one at home.

(13) Decoration should be done in accordance with the norms of house design, raw materials purchase, construction and other links to avoid leaving hidden dangers.

(14) Electric fire monitoring system can be installed (electric fire alarm system). The signs of the electric fire can be converted into identifiable information by technical means in order to achieve the purpose of monitoring electric fire and send out an alarm before an electric fire occurs.

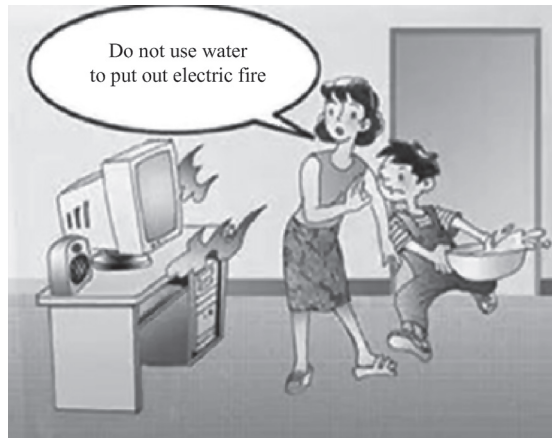


Figure 4-14 Do not use water to put out electric fire

Only by enhancing safety consciousness, mastering the basic safety knowledge of electric fire prevention and strictly using electric appliances according to regulations, can we effectively prevent the occurrence of household electric fires and fully ensure the safety of household electricity consumption.

4.4A



The Harm of Static Electricity

Electrostatic voltage may be very high! When you hear the “crackle” of electrostatic discharge, the static electricity (Figure 4-15) on your body may be as high as 7000-8000V.

There is a lot of harm of static electricity, such as below.

Harm to Human Body: The static electricity produced by dry can affect the central nervous of people, causing people to feel fatigue, irritability, insomnia and headache. If the static electricity carried by human body reaches thousands of volts or even tens of thousands

of volts, it will seriously disturb and even change the inherent potential difference in the human body, especially affecting the normal operation of the heart. High voltage electrostatic discharge causes electric shock, and may even endanger personal safety.



Figure 4-15 Static electricity in daily life

Harm to Industrial Production: The harm caused by static electricity to industrial production mainly includes: absorbing dust, causing pollution of integrated circuits and semiconductor components, and greatly reducing the yield of finished products. Or it may cause the failure or malfunction of the electronic equipment, causing electromagnetic interference.

To Cause a Fire or Explosion: The sparks from static electricity may cause fire or ignite some flammable objects and explode. On the operating table, electrical sparks can cause anesthetic explosion that injures the doctors and patients. In coal mines, static electricity can cause gas explosions, resulting in mine collapse and workers' death and injury.

The generation of static electricity is inevitable, so we must pay attention to electrostatic protection.

New words

electrostatic [ɪˌlektroʊ'stætɪk] adj. 静电式的；静电的，静电学的

discharge [dɪs'tʃɑːdʒ] vt. 执行

vt.& vi. 放出；发射

n. 流出

static ['stætɪk] adj. 静止的；静电的 [物] 静力的

n. 静电；静力学

irritability [ˌɪrɪtə'bɪləti] n. 易怒；过敏性；兴奋性；感应性

insomnia [ɪn'sɒmniə] n. 失眠，失眠症

integrate ['ɪntɪɡreɪt] vt. 使一体化；使整合；使完整

adj. 整体的；完整的

semiconductor [ˌsemɪkən'dʌktə(r)] n. 半导体

component [kəm'pəʊnənt] n. 成分；组分；零件；[数] 要素

adj. 成分的；组成的

ignite [ɪɡ'naɪt] vt. 点燃；使燃烧；使激动；使灼热

vi. 点火；燃烧

flammable ['flæməbl] adj. 易燃的，可燃的

explode [ɪk'spləʊd] vt. (使) 爆炸；突然发出(巨响)、活跃(起来)、迸发(感情)

Phrases and Expressions

electrostatic voltage: 静电电压

electrostatic discharge: 静电放电

static electricity: 静电

potential difference: 电位差

Notes

(1) When you hear the “crackle” of electrostatic discharge, the static electricity on your body may be as high as 7000-8000V.

when 引导原因状语从句→当你听到。

(2) The static electricity produced by dry can affect the central nervous of people, causing people to feel fatigue, irritability, insomnia and headache.

这句话中，主语是 The static electricity；谓语是 can affect，宾语是 the central nervous → causing 加后面的内容以现在分词短语的形式出现，表示伴随，作为对主句的补充。句中 causing people to feel... 这部分用现在分词短语作为状语，就相当于一个

从句，等同于 which can cause people…。

(3) The harm caused by static electricity to industrial production mainly includes: absorbing dust, causing pollution of integrated circuits and semiconductor components, and greatly reducing the yield of finished products.

整个句子主语是 The harm，谓语是 includes，句子结构是 The harm includes → include 后面是三个并列成分，核心词语为：absorbing、causing、reducing。

4.4B



Tips for Eliminating Static Electricity in Daily Life

It is very easy to generate static electricity in dry weather (Figure 4-16). Although static electricity almost does not harm human life, it does have many negative effects on human health. For example, some people with arrhythmia could not find organic lesions and the cause of arrhythmia. However, when they followed the doctors' advice to change to wear pure cotton clothes, their heart rate soon returned to normal. Let's take a look at some simple and effective ways to eliminate static electricity in our daily life.



Figure 4-16 Static electricity in daily life

(1) Dry skin is prone to generate static electricity. Therefore, in winter and spring and other dry seasons, moisturizing cosmetics can be used more. Keep skin moist and prevent the generation of static electricity.

(2) Try to wear cotton, silk clothes and rubber-soled shoes, but no chemical fiber clothing. After taking off clothes, touch the wall with your hand before touching the tap or door so as to discharge the static electricity on the body.

(3) Dry environment is beneficial to the accumulation of static electricity. Therefore, you must maintain certain humidity indoors, mop the floor and sprinkle the water frequently. The static electricity generation can be effectively suppressed if you use a humidifier, or place open containers with water in the room. It is also a good way to regulate the indoor humidity by placing ornamental fish or potted plants in the room.

(4) Washing your hands and face, bathing and changing clothes regularly can effectively eliminate the static electricity and charged dust on the surface of body. Barefoot is conducive to discharge static electricity that accumulates on the body surface, so you can release static electricity with barefoot during leisure time. Eating more yogurt, vegetables, fruits and other acid food, drinking more water and paying attention to supplement calcium and vitamin C can maintain the body electrolyte balance and reduce static electricity.

(5) People with more static electricity should not touch other people casually, especially infants, the elder and people with heart disease and hypertension, otherwise, the consequences may be very serious. Static electricity must be eliminated before touching.

(6) In case of the hair with static electricity, spray the hair with water or let the comb soak dip into the water and then comb the hair.

(7) To avoid static impact, small metal devices (such as keys) can be used to touch doors, doorknobs, faucets, chair back, bedrails and so on, and then touch them with your hands.

(8) Many computer workers have many facial diseases such as erythema, pigmentation and so on. This is due to the static electricity generated by the computer screen, attracting a lot of suspended dust, which makes the face stimulated. The precautions are to wash your hands and face immediately after you leave the computer or turn off the display device, so that the static charge on the surface of the skin will be released in water.

(9) The shell of electric appliances such as hair dryers, refrigerators and washing machines can also carry static electricity. In order to ensure safety, the shell of refrigerators and washing machines must be properly grounded. It can also prevent injury and death accidents from occurring in the electrical housing leakage.

(10) Try to avoid using chemical fiber carpets and furniture and appliances with plastic surface to prevent electrification generated by friction.

(11) Place a basin of water under the heating, putting one head of well-drained cloth in the water and the other head on the heating. The whole room will be moist and pleasant, reducing the possibility of static electricity generation.

(12) Static electricity is easy to accumulate if you stay indoors for a long period of time.

You can go for outdoor activities more often, and release the static electricity into the air as much as possible.

(13) Wear earphones less in winter. If the body has more static electricity, it will be released through the earphones into the ear canal and damage your ear.

(14) Bring a small bottle of spray water and spray at any time. A small bottle of tap water is enough for one day.

To sum up, we can take ways of “prevention” and “release” to deal with static electricity. “Prevention” is to avoid using the object that can generate static electricity easily and pay attention to frequent ventilation indoor. “Release” means increasing humidity to make the local static electricity easy to be released.

Unit 5

Electrotechnics and Electronics

5.1



Father of Deep Learning

Geoffrey Hinton, a professor of computer science at the University of Toronto, is the founder of Deep Learning. In 2013, Google spent tens of millions of dollars to buy DNNresearch, a startup company of the University of Toronto which had only three members, to get Geoffrey Hinton to work for them. Let's talk about his story.

What is deep learning? Deep learning is studying how to simulate a neural network in human brain with computer. It simulates or realizes the human learning behavior, so as to make it like human beings to have the ability of self-learning.

A wide-spread example is that Google built the world's largest electronic simulated neural network with 16,000 computer processors and showed it 10 million pieces of randomly selected videos from YouTube. The artificial neural network autonomously learned to recognize the faces of cats under spontaneous conditions without outside instructions.

Since it came up in 2006, Deep Learning has greatly pushed forward the progress in speech recognition, vision, and natural language processing.

When studying psychology at the University of Cambridge, Geoffrey Hinton learned that the human brain had billions of nerve cells which interacted with each other through synapses and formed extremely complex interconnections. How the nerves study and calculate is the question he has been trying to study.

This issue has made some progress under his efforts. With his partners, he built layers of interconnected artificial neuron models that simulated the behavior of the brain and handled complex issues such as vision and language.

In the early 1980s, computer performance was far from being able to handle the huge

data sets required by artificial neural network (ANN). After a short period of intense research, research on artificial neural network fell into a depression.

In the next couple of decades, although there are still some researchers who insist on the study of artificial neural network, the research on artificial neural network in the academic community has basically stagnated. The researchers could not get the relevant scientific research funds. There are very few publications on high-quality papers related to artificial neural network. Even the prestigious academic conference, Conference on Neural Information Processing Systems (NIPS), has become a conference with nothing to do with artificial neural network.

Geoffrey Hinton's academic career also fluctuates like the development of artificial neural network. Fortunately, he has not given up the research on artificial neural network. In order to realize their dreams, Geoffrey Hinton and his partners regularly gathered and held seminars to build up more powerful deep learning algorithms and operate larger data sets.

However, academic circle is still not interested in the study of artificial neural network, and their research is difficult to apply for research funding. It is not unreasonable that the academic circle is deserted. Most achievements of the artificial neural network can hardly be explained or proved by mathematics. Everyone is just constantly adjusting parameters and improving algorithms to obtain better results.

The turning point in the matter occurred in around 2006, when Geoffrey Hinton and his students invented an engineering method to optimize artificial neural network by using GPU, and published papers in *Science* and other related journals. The concept of "Deep Belief Network" was first proposed. He gave a new term to related learning methods of multi-layer neural network—"deep learning."

Subsequently, deep-learning research shined brightly and was widely used in image processing and speech recognition. For example, Geoffrey Hinton's students won the 2012 Image Net with a deep learning algorithm.

The giants of the Internet began to notice them, this area rapidly began to get hot. The Internet companies which are closest to artificial intelligence are keenly aware of this opportunity. Since the beginning of 2011, the maturity of deep learning algorithms has led to a leap in artificial intelligence technology. Companies including Microsoft, Apple, Google, Facebook, and domestic "BAT" have all started to deeply deploy artificial intelligence and deep learning, trying to grasp the wind gap and become the giant of next industrial transformation.

5.2A



Circuits

An electric circuit usually consists of four parts: a power source such as a battery, the conductors or wires, a control device such as a switch, and a load. The load is a set of devices or a machine. A substantive conversion of energy occurs within the load. The bulb, the resistor and the motor are common examples of electric loads.

Any combination of a conductor and an electromotive force that allows electrons to flow continuously in a return circuit is called an electric circuit.

As shown in Figure 5-1, a bulb being connected across a dry battery is an example of a simple electrical circuit.

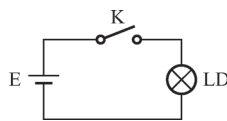


Figure 5-1 A circuit

Current flows from the positive terminal (+) of the battery through the bulb to the negative terminal (–). The function of the battery is to provide a “regenerative” path to ensure that the stream of electrons flow back to the positive terminal (+) again.

As long as the circuit remains unbroken at any point, it is a closed circuit (Figure 5-2) and

the current can flow. Once the pathway is broken, it will immediately become an open circuit

(Figure 5-3) and the current cannot flow.

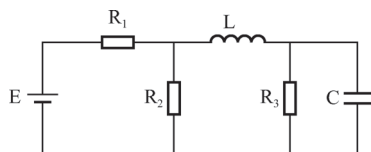


Figure 5-2 A closed circuit

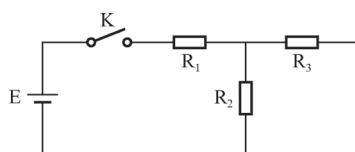


Figure 5-3 An open circuit

Series circuits and parallel circuits are two main forms of circuit connection. Many actual circuits are series-parallel combined.

New Words and Expressions

battery ['bætəri] n. 电池, 蓄电池

conductor [kən'dʌktə(r)] n. 导体

load [ləʊd] n. 负载, 负荷

conversion [kən'vɜ:ʃən] n. 转换, 改变, 转变

combination [ˌkɒmbɪ'neɪʃn] n. 结合(体); 联合(体)

e.m.f. 电动势

negative ['negətɪv] adj. 负的

positive ['pɒzɪtɪv] adj. 正的

regenerative [rɪ'dʒenərətɪv] adj. 再生的; 反馈的

electron [ɪ'lektɹɒn] n. 电子

pathway ['pɑ:θweɪ] n. 通路, 径

unbroken ['ʌn'brəʊkən] adj. 未破损的, 完整的, 不间断的

Phrases and Expressions

dry cell: 干电池

positive terminal: 正极

closed circuit: 闭路

power supply: 电源

series circuits: 串联电路

Notes

(1) Any combination of a conductor and an electromotive force that allows electrons to flow continuously in a return circuit is called an electric circuit.

that allows electrons to flow continuously → that 引导一个定语从句，修饰先行词 combination → 让电子连续流动的。

is called an electric circuit → 一般现在时态的被动语态 → 被称为电路 → 在科技英语中，被动语态的一种翻译方法是直接翻译成主动语态。

(2) The function of the battery is to provide a “regenerative” path to ensure that the stream of electrons flow back to the positive terminal (+) again.

整个句子是“主系表”结构，主语是 The function，系动词是 is，表语是 to provide a “regenerative” path。

(3) Once the pathway is broken, it will immediately become an open circuit (Figure 5-5) and the current cannot flow.

Once the pathway is broken, it will immediately become an open circuit (Figure 5-5) → 在一般将来时态中，时间状语从句用一般现在时态表示 → 这条路径一旦断开，它马上就变成开路（见图 5-5）。

and the current cannot flow → and 为连接词，在句子中可以不翻译出来 → 电流就不能流过。

5.2B



Series and Parallel Circuits

Series circuits:

Circuit components can be connected in many different ways. The two simplest connections are in series and in parallel, and these two connections are very common. In a series circuit, the current pass through a single path, so the current flowing through all of the components is the same.

A circuit consisting of only series components is called a series circuit (Figure 5-4).

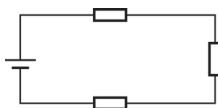


Figure 5-4 Series circuit

In a series circuit, the current can only flow through one path, and the current flows through each component of the circuit.

(1) Voltage:

$$U=U_1+U_2+\cdots+U_n$$

In a series circuit, the total voltage is equal to the sum of the voltages of each component.

(2) Current:

$$I=I_1=I_2=\cdots=I_n$$

In a series circuit, the currents flowing through all the components are equal.

(3) Resistance:

As shown in Figure 5-5, the total resistance of series circuits is equal to the sum of their individual resistance.

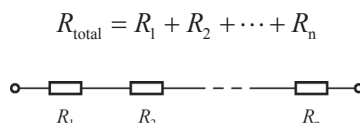


Figure 5-5 The total resistance of series circuit

Parallel Circuits:

A circuit composed completely of parallel components is called a parallel circuit (Figure 5-6). In a parallel circuit, the voltage at both ends of each element is equal, and the total current is equal to the sum of the current of each component. If two or more components are connected in parallel, their electromotive force (voltage) at both ends is equal and has exactly the same polarity.

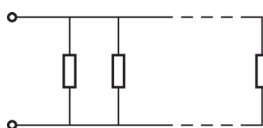


Figure 5-6 Parallel circuit

(1) Voltage:

In parallel circuit, all the components have the same voltage.

$$U=U_1=U_2=\cdots=U_n$$

(2) Current:

$$I=I_1+I_2+\cdots+I_n$$

The total current is equal to the sum of the currents of individual component.

(3) Resistance:

The current of a single resistance can be calculated according to Ohm's law.

$$I_{\text{total}} = U \left(\frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n} \right)$$

It is known that (from the formula above) the reciprocal total resistance of all components is equal to the reciprocal sum of each resistance. The total resistance is always less than the value of the minimum resistance.

$$\frac{1}{R_{\text{total}}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}$$

5.3A



Ohm's Law

In 1826, German physicist George Simon Ohm published a pamphlet that described the initial exploration of measuring current and voltage, and had a mathematical way to describe their relationship. The pamphlet describes what we now call the basic relationship of Ohm's law, although it has been confirmed that this result was discovered nearly 50 years ago by Henry Cavendish in England. Ohm's pamphlet received much undeserved criticism and derision for several years after its first publication, but it was later accepted and named the basic relationship after him.

Ohm's law states that the voltage at both ends of a conductive material is proportional to the current flowing through it.

Among them, the measurement unit of proportionality constant is V/A, customarily abbreviated as Ω . When this equation is plotted on the U - I axis, the graph is a straight line

through the origin as shown in Figure 5-7. In a simple circuit, if the ratio of the current-to-voltage of a component is a constant, then the component is a linear resistor, and its resistance is equal to the voltage-to-current ratio (Figure 5-8).

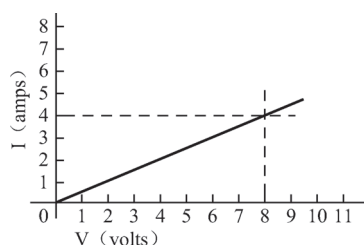


Figure 5-7 Current-Voltage Relationship for Linear Resistor

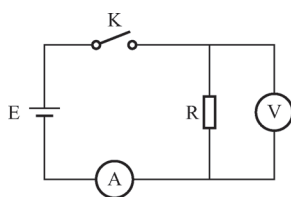


Figure 5-8 The experiment circuit diagram of Ohm's Law

The discovery of Ohm's law and its formula reveals the relationship between resistance, current and voltage, which brings great convenience to the calculation of electricity. It's a landmark contribution in the history of electricity.

New Words

pamphlet ['pæmflet] n. 小册子；活页文选

statement ['stetmənt] n. 声明；表现；陈述

undeserved [ˌʌndrɪ'zɜ:vəd] adj. 不恰当的，不应得的

criticism ['krɪtɪsɪzəm] n. [哲] 批判主义；评论；批评；校勘；苛求

ridicule ['rɪdɪkjʊ:l] n. 嘲笑，奚落

vt. 嘲笑，嘲弄

proportionality [prə'pɔ:ʃə'næləti] n. 成比例；比例（性）；相称

customarily ['kʌstəmərəli] adv. 习惯上，习俗上，通常

abbreviate [ə'brɪ:vieɪt] vt. 缩写，使省略 [(+to)]

equation ['ɪkwɪʃn] n. 方程式；等式；相等

plot [plɒt] vt. 以图表画出，把……分成小块

versus ['vɜ:səs] prep. 与……相对

axes ['æksɪ:z] n. 轴；轴线；斧头（ax 的复数形式）

formula ['fɔ:mjələ] n. 公式，准则；方案；婴儿食品

Phrases and Expressions

Georg Simon Ohm: 乔治·西蒙·欧姆

pass through: 通过

voltage-to-current ratio: 电压电流比

associated with: 与……关联

brings great convenience to: 为……带来极大便利

Notes

(1) In 1826, German physicist George Simon Ohm published a pamphlet that described the initial exploration of measuring current and voltage, and had a mathematical way to describe their relationship.

had a mathematical way to describe their relationship → 其中 to describe their relationship 是不定时短语，表示目的 → 用数学方式来描述它们的关系。

整个句中有两个 and。第一个 and 的并列成分为 current and voltage；第二个 and 的并列成分为：a pamphlet that described..., and had a mathematical way... 第二个 and 前省略了 a pamphlet。a pamphlet that described..., and (a pamphlet) had a mathematical way...

(2) The pamphlet describes what we now call the basic relationship of Ohm's law, although it has been confirmed that this result was discovered 46 years ago by Henry Cavendish in England.

what we now call the basic relationship of Ohm's law → what 引导一个宾语从句 → what we now call the basic relationship of Ohm's law 为动词 describe 的宾语。

although it has been confirmed → although 引导一个让步状语从句 → has been confirmed 为使用现在完成时态的被动语态 → 虽然现已证实。

that this result was discovered 46 years ago by Henry Cavendish in England → that 引导一个宾语从句 → 早在 46 年前卡文·迪许在英国就发现这个结果。

(3) Ohm's law states that the voltage at both ends of a conductive material is proportional to the current flowing through it.

that 引导宾语从句 → 在宾语从句中，the voltage 是主语，is 是系动词 → 导电材料两

端的电压与（其中）流过的电流成正比。

5.3B



Kirchhoff's Current Law

We are now ready to study the first of the two laws named after Gustav Robert Kirchhoff, a university professor of Germany who was born about the time when Ohm was doing his experimental work. This axiomatic law is called Kirchhoff's current law (abbreviated as KCL), and it simply states that: The algebraic sum of the currents of each branch flowing into any node is zero.

This law mathematically illustrates the fact that charge cannot accumulate at a single node. A node is not a circuit element, and it certainly cannot store, destroy, or generate charge. Hence, the sum of current must be zero. Here, a comparison (analysis) with water is useful: for example, supposing water in three pipes flow into point *Y*. If we keep the water flowing, the pipes will burst due to the constantly increasing pressure. The actual flow direction of water is an example of how we define the direction of a non-independent current. Therefore, one or more current must be defined as negative.

At the node shown in Figure 5-9, the algebraic sum of the five current flow into the node must be zero:

$$I_1 + I_2 + I_3 + (-I_4) + (-I_5) = 0$$

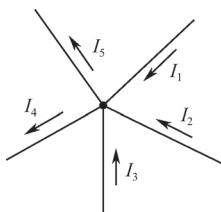


Figure 5-9 An application example of KCL

Obviously, the law could also be applied to the algebraic sum of the current flowing out of the node:

$$(-I_1) + (-I_2) + (-I_3) + I_4 + I_5 = 0$$

We can also see that the sum of the current flowing into the node is equal to the sum of the current flowing out of the node:

$$I_1 + I_2 + I_3 = I_4 + I_5$$

The above equation briefly illustrates that the sum of the current flowing in must equal the sum of the current flowing out.

$$\sum_{n=1}^N I_n = 0$$

It is the following brief expression:

$$i_1 + i_2 + \dots + i_n = 0$$

It is not difficult to understand that, in the equation, the N current can neither all point to one node nor all back to it.

For example: in Figure 5-10, assume that the current flowing through E_1 is 2A, and calculate the current flowing through the resistor R_3 .

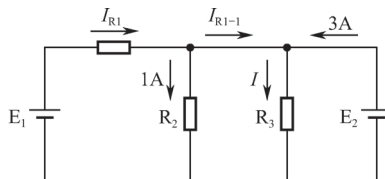


Figure 5-10 The application of Kirchhoff's Current Law

Identify the problem: It has been indicated that the current flowing through resistor R_3 is I in the circuit diagram.

Collect the known conditions: This current flowing through the upper node of R_3 comes from other branches. Each current flowing into the node adds up to form the current I .

Decide which available method is best suited: We start with the identified current that flowing through R_1 , so that we may write the KCL equation at the node above R_2 and R_3 .

Create corresponding equation. Add the current flowing into this node:

$$I_{R1} - 1 - I + 3 = 0$$

Determine whether additional conditions are required: It can be seen that we built one equation with two unknowns, which means we need one equation more. At this point, we know that the E_1 provides 2A current. KCL indicates that this is also the current flowing through R_1 .

Attempt a solution: Substituting, we get:

$$I = 2 - 1 + 3 = 4A$$

Verify the result. Is it reasonable or expected?

Our review work is often worthwhile. Also, we are trying to figure out whether the result is reasonable at least. In this example, there are two power supplies: one provides 2A current and the other provides 3A current. There is no other controlled or independent power supply. Thus, it's normal that we couldn't find any current in excess of 5A in the circuit.

5.4A



Digital System

Our most familiar digital system is based on 1 and 0, that is, the decimal system. However, in recent years, the development of science and technology needs people to produce other digital systems, such as the need for electronic computers to develop digital systems that can be adapted to electronic processing. These digital systems are binary (base 2), octal (base 8) and hexadecimal (base 16).

Binary code is the basic language of computers, while octal and hexadecimal codes are commonly used for computer communication and storage of information, which is shown in Table 5-1.

Table 5-1 Inter-conversions between different codes

Decimalism	Binary	Octal	Hexadecimal	Decimalism	Binary	Octal	Hexadecimal
0	0000	0	0	8	1000	10	8
1	0001	1	1	9	1001	11	9
2	0010	2	2	10	1010	12	A
3	0011	3	3	11	1011	13	B
4	0100	4	4	12	1100	14	C
5	0101	5	5	13	1101	15	D
6	0110	6	6	14	1110	16	E
7	0111	7	7	15	1111	17	F

Because computers can only handle binary data or binary encoding in other systems, decimal code must be converted to one of these codes before they can be processed by

computers. When computer has finished processing the given information, the output information is printed or displayed in a non-decimal form, so the output information must also be reconverted, this time back to the decimal code.

Digital electronics technology is about logical science. Generally speaking, logic is a subject of reasoning according to general principles. Digital logic is a subject of digital reasoning. Almost all functions of digital (logical) systems can be implemented by special circuits, called gate. If the logical operation is too complex to be implemented by a single gate, it can also be implemented by a combination of several gates. These extended logical circuits are called combinational logical circuits (Figure 5-11).

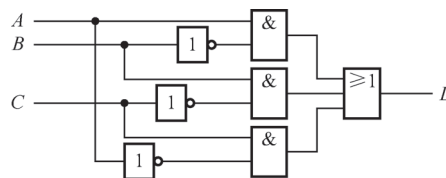


Figure 5-11 Combinational logical circuits

New Words

digital ['dɪdʒɪtl] adj. 数字的；数据的；手指的

n. 数字；手指

binary ['bɪnəri] adj. 二进制的

n. 一双，二进制数

octal ['ɒktl] adj. 八进制的

hexadecimal [ˌheksə'desɪml] adj. 十六进制的

Phrases and Expressions

digital system: 数字系统

too...to...: 太……而不能……

combinational logical circuit: 组合逻辑电路

Notes

(1) However, in recent years, the development of science and technology needs people to produce other digital systems, such as the need for electronic computers to develop digital systems that can be adapted to electronic processing.

这句话中 such as 译为“例如，比如”，the need for 译为“对……的需要”，that can be adapted to electronic processing 中 that 在此句中引导定语从句，在从句中作为主语，其先行词是 systems，adapt to 译为“适应”。

(2) When computer has finished processing the given information, the output information is printed or displayed in a non-decimal form, so the output information must also be reconverted, this time back to the decimal code.

has finished processing 为完成进行时语态，翻译为“当计算机处理完毕后”；the given information 中 given 是过去分词，作为 information 的定语，可以翻译为“所给的信息”；so 译为“因此”，be reconverted 为被动语态，译为“被再次转换（再转换）”。

(3) If the logical operation is too complex to be implemented by a single gate, it can also be implemented by a combination of several gates.

too...to...译为“太……而不能……”，by a single gate 译为“只用一个门（电路）”。

5.4B



Logical Gates

1. AND Gate and NAND Gate

The two basic logic functions are the AND and NAND functions. The difference between these two functions is that they are complementary, that is, they are opposite in function.

The digital logic function of the AND gate is that its output is high when all of its inputs are high. Figure 5-12(a) gives a symbol for the AND gate, which has two input terminals, *A* and *B*, and an output terminal *C*. The gate can have up to eight input terminals.

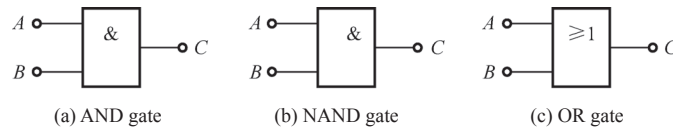


Figure 5-12 Symbols of gates

When the two inputs of the AND gate are high level (1), it outputs a high level (1).

This relationship can usually be written as:

$$C = AB$$

This expressing can be described as: when A equals 1 and B equals 1, then C equals 1.

The Symbol of NAND gate is shown in Figure 5-12(b), which is more commonly used than the AND gate, which is complementary to the AND gate, i.e. its output is logically opposite to the AND gate. Because the circuit implementation of the NAND gate is relatively simple, it is cheaper than AND gate and more convenient for use. The letter N in front of the AND means “non”.

There are different representations for a NOT gate in logic expressions. A “non” relationship is usually indicated by adding an over line to the letter. For example:

$$C = \overline{AB}$$

It means “A and B are equal to Non-C”. In the NAND gate, the output is a high level(1) in most cases, except when all inputs are high level(1), and the output of the NAND gate is a low level(0) .

2. OR Gate

The Symbol of OR gate is shown in Figure 5-12(c). The logical function of the OR gate refers to that when any input of the OR gate is a logical high level (1), it outputs a high level (1), which can usually be written as:

$$C = A + B$$

The plus sign (+) means that the OR logic relationship can be described as:” if A or B equals 1, C equals 1”.

3. Combinational Logic Gate

Logic gates are like building blocks, only one of which can be used if only a single logic relationship is needed, but they can also be combined with other logic gates to form a combinational logic gate when more complex operations are implemented. Sometimes it is better to use one logic gate to replace other logic gates. Designers can use logic gates at hand to implement various circuits, which indicates the versatility and flexibility of combinational logic gate.

Unit 6

Instruments and Tools

6.1



China's First Large Airliner with Independent Intellectual Property Rights——C919

On May 5th, 2017, people held their breath and looked at the busy Pudong International Airport from distance. An airliner, painted with the blue sky and green earth, gently stretched its youthful wings and landing steadily on the fourth runway. China's first main line civil aircraft, which developed in accordance with the latest international air worthiness standards and with full independent intellectual property rights, made its maiden flight successfully! It marks a historic breakthrough in the Chinese people's century-old dream of a great airliner (Figure 6-1)! Its name is C919! "C" is not only the first letter of "COMAC", but also the first letter of Chinese English name "CHINA", which embodies the will of the country and the expectations of the people. The first "9" means "everlasting"; "19" represents C919 large airliner with a maximum capacity of 190 people. The C919 airliner is a medium/short-distance commercial aircraft with a total length of 38m, a wingspan of 20m and a height of 12m. Its



Figure 6-1 C919's first flight

basic layout has 168 seats. The standard voyage is 4,075km, with a maximum range of 5,555km and an economic life of 90,000 flying hours.

The C919 large airliner is designed in accordance with more advanced technical standards, adopts world-class power, avionics and flight control systems, and is designed and produced in full accordance with international air worthiness standards. The safety is fully guaranteed. It shows the overall scientific and technological strength of China's aviation industry and "Chinese Wisdom". There are several major technological breakthroughs in the design and development of the C919, such as the successful application of 3D printed titanium alloy parts for the first time and the design of super critical wings. It is the first time that Chinese engineers have designed super critical wings independently, which have reached the advanced level in the world and have been recognized by the international counterparts.

The designers of the C919 large airliner have made great efforts to implement the design of weight reduction and drag reduction, which has greatly reduced the Special Fuel Consumption (SFC) of the cruise and made the economically competitive advantage obvious; the external field noise meets the noise requirements of the fourth stage of the International Civil Aviation Organization (ICAO) and has a margin. Nitrogen oxide emission is 50% lower than that required by the International Civil Aviation Organization (ICAO) CAEP6, which is good to environmental protection. The capacious fuselage of the C919 large airliner will provide more space for passengers to ride, and use an efficient air filtration system to provide high quality fresh air. Cabin lighting adopts humanized scene lighting design to provide passengers with a warm, considerate and comfortable environment.

On November 10th, 2017, the first C919 large airliner flew over a long distance, transferred from Pudong Airport to Xi'an Yanliang Airport, and COMAC entered the next step of R&D test flight and air worthiness certification. On December 17th, 2017, the second C919 passenger aircraft completed its first flight, which means that the C919 large airliner gradually started the new journey for the full test flight. Until March 2018, C919 has received orders of 815 planes from 28 customers worldwide.

In the future, with the advancement of the C919 large airliner project and the mass production of our country's jetliner, China's civil aviation industry chain will gradually develop the enormous economic potential. The basic features of China's civil aviation industry will be greatly improved.

6.2A



Virtual Instrument

Virtual instrument is an analog instrument running in a computer. The two physical structures of it are computer hardware, measurement and control hardware. By running the programmed driving software on computer, the information can be exchanged with the measurement and control hardware, and the signal test can be completed by virtual instrument (Figure 6-2).

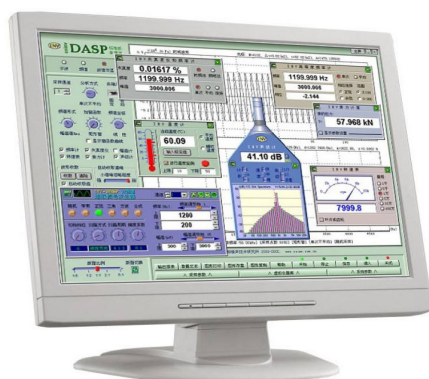


Figure 6-2 Virtual instrument based on computer technology

Virtual instrument has the following main advantages:

- (1) Virtual instrument is widely used. With different measurement and control hardware, users can define many kinds of instrument in the software.
- (2) It is no need using the physical interface of the conventional instrument that the

virtual instrument can accomplish any operation directly by displaying a graphical panel on computer through mouse and keyboard.

(3) Virtual instrument runs directly in a computer, so data collection, editing and process control are quite free, and there is almost unlimited storage space for data records.

(4) After the data analysis software is installed, the obtained data can be analyzed, processed and shared with the network in the computer in real time.

(5) Virtual instrument can be programmed on its own. It is not only cheap but also freely combined. It's no longer be limited by the instrument manufacturers.

Virtual instrument is an important revolution of computer technology and information technology in the field of instrument. It is the research and development direction of instrument and instrument test control in the future.

New Words

virtual ['vɜ:tʃuəl] adj 实质上的, 事实上的; [计算机] 虚拟的

analog ['ænələ:g] n. 类似物, 同源语; [计算机] 模拟

resistance [rɪ'zɪstəns] n. 电阻; 阻力; 抵抗; 抗力

structures ['strʌktʃəz] n. 结构 (structure 的名词复数); [生物学] 构造; 机构

hardware ['hɑ:dweə(r)] n. 五金器具; 计算机硬件; 武器装备

programmed [prəʊ'græmd] v. 训练 (programme 的过去式和过去分词); 培养; 编程

software ['sɒftweə(r)] n. 软件; 软设备

information [ˌɪnfə'meɪʃn] n. 消息; 信息, 数据; 通知; 知识

exchange [ɪks'tʃeɪndʒ] v. 换回; 交换, 替换

combined [kəm'baɪnd] adj. 结合的

development [dɪ'veləpmənt] n. 发展, 进化, 开发区

Phrases and Expressions

virtual instrument: 虚拟仪器

measurement and control hardware: 测控硬件

information technology: 信息化技术

Notes

(1) By running the programmed driving software on computer, the information can be exchanged with the measurement and control hardware, and the signal test can be completed by virtual instrument.

本句包含表示前后顺序的两个并列现在一般时态语句，由 by 引导方式状语，driving software 译为“驱动软件”，on the computer 译为“在计算机上”，exchanged with 译为“交换”。

(2) Virtual instrument runs directly in a computer, so data collection, editing and process control are quite free, and there is almost unlimited storage space for data records.

该句包含表示因果的三个并列单句，每一句均为一般现在时态。Virtual instrument runs directly in a computer 译为“虚拟仪器直接运行在计算机中”；so data collection, editing and process control are quite free 译为“所以数据的采集、编辑和过程控制相当自由”；and there is almost unlimited storage space for data records 译为“而且具有几乎无限的数据记录存储空间”。

(3) After the data analysis software is installed, the obtained data can be analyzed, processed and shared with the network in the computer in real time.

本句包含表示前后顺序的两个被动语态并列句，其中 After the data analysis software is installed in the computer 译为“计算机安装数据分析软件后”，analyzed, processed, shared 三者为并列关系，均为被动语态。

6.2B

LabVIEW Virtual Instrument



If you are an engineer, in the process of your work you will use a lot of professional equipments to do all kinds of work. First, you have to spend a large amount of money to buy

all kinds of instruments and meters. Second, you also have to have this expensive equipment carried on at each job for field testing. Now, you don't have to bother so much, because virtual instrument is already on the market. You can easily finish your work just by carrying a laptop, with the required virtual instrument software installed in the laptop and a few additional supporting measure and control hardwares installed in your computer bag.

In 1986, NI (National Instruments) issued the LabVIEW 1.0 running on the Macintosh platform, marking the advent of virtual instrument. It caused a major change in the field of traditional instruments, which made computer and network technology driven into the field of instruments and combining instrument technology, thus it created a pioneer of “software is instrument”. With the unremitting efforts of National Instruments for decades and the focus on R&D and production, the LabVIEW virtual instrument has become a well-deserved leader in the industry (Figure 6-3).

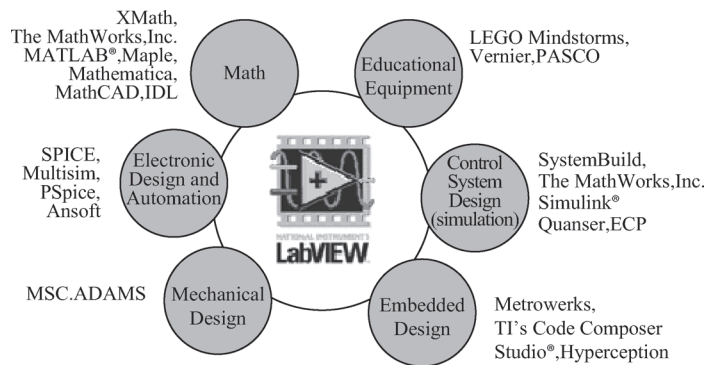


Figure 6-3 Introduction to the application of LabVIEW

The LabVIEW developing environment integrates all the tools that engineers and scientists need to quickly build all kinds of application instruments. With the powerful data processing function of the computer, users can define and manufacture various instruments according to their own needs. You can be free to create the perfect instrument in your mind like building block (Figure 6-4).

The application areas that most highlight the advantages of LabVIEW are as follows:

1. Testing and measuring field

LabVIEW was originally developed for testing and measuring. Most mainstream testing instruments and data acquisition devices have special LabVIEW drivers, and users can easily find various LabVIEW toolkits suitable for testing and measuring. Sometimes users can simply invoke functions in several toolkits to form a complete test measurement virtual instrument.

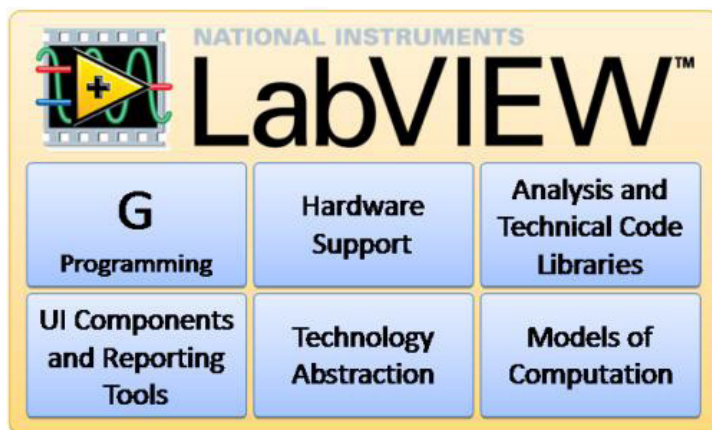


Figure 6-4 The “building blocks” that LabVIEW provides

2. Controlling

Controlling and testing are two highly correlated fields. LabVIEW, which started in the field of testing, naturally extended to the field of controlling first. LabVIEW has a special program function module for the field of controlling. In addition, the commonly used equipments of the industrial controlling field, data cable and so on are usually equipped with the corresponding LabVIEW drivers. Various controlling programs can be easily programmed by using LabVIEW.

3. Simulation

For example, before designing an electromechanical equipment, we can use LabVIEW to build the simulation model on the computer to verify the rationality of the design and find the potential problems. In the field of higher education, sometimes it is possible to use LabVIEW for software simulation to achieve the same effect, which students do not lose the opportunity to practice without practical instruments.

4. Children's education

Because graphics are easy to attract children's attention and they are easier to be understood than words, LabVIEW can be understood as a special “building block” for children who have no computer knowledge. You can achieve the functions that you need by putting different components together. Lego Blocks are designed by using the LabVIEW programming language. Children can easily use Lego Blocks to build vehicles, ships, robots and so on, and then use LabVIEW to write programs to control their movements and behavior. In addition to the toy, LabVIEW has a version for primary and secondary school students.

In short, LabVIEW has transcended the boundaries of instrumentation, work and life. Someone even said: “I thank LabVIEW from the bottom of my heart. It does not make me feel lonely before and even after I’m retired.”

6.3A



Multimeter

Multimeter, also called Universal Meter, is a kind of measuring instrument with multi-function and multi-range. In general, multimeter can measure DC current, DC voltage, AC current, AC voltage, resistance and some other parameters. Multimeter is a necessary instrument for modern electronic measurement and maintenance.

When the multimeter is used, there is a multi-gear rotary switch to select the measuring object and the corresponding measuring range on the gauge outfit. There are two external probes: the red one and the black one. The red one should be inserted into the socket marked “+” and the black one should be inserted into the socket marked “-” when used.

The multimeter is divided into pointer multimeter (Figure 6-5) and digital multimeter (Figure 6-6) according to display mode. The pointer multimeter is a kind of average meter, and the measured value is read by the pointer on the dial of the gauge outfit. The readout is intuitive and visual. The measured value of the digital multimeter is displayed directly in the

form of digital by the liquid crystal display screen. The portable (pocket) digital multimeter has the following characteristics: clear display, high accuracy, wide testing range, complete testing function, strong anti-interference capability, simple operation, high reliability, easy to carry and so on. As a result, digital multimeter has been rapidly popularized and widely used, and it is gradually replacing the traditional pointer multimeter.



Figure 6-5 Pointer multimeter



Figure 6-6 Digital multimeter

New Words

universal [ˌjuːnɪˈvɜːsl] adj. 普遍的，一般的；通用的，万能的

instrument [ˈɪnstrəmənt] n. 仪器；乐器；手段；工具

resistance [rɪˈzɪstəns] n. 电阻；阻力；抵抗

parameter [pəˈræmɪtə] n. 因素，特征；界限

electronic [ɪˌlekˈtrɒnɪk] adj. 电子的

measurement [ˈmeɪʒəmənt] n. 量度；测量；尺寸

corresponding [ˌkɒrəˈspɒndɪŋ] adj. 相当的，对应的

external [ɪkˈstɜːnl] adj. 外面的，外部的；表面上的

probe [prəʊb] n. 探头；探查

digital [ˈdɪdʒɪtl] adj. 数字的；手指的；指状的

Phrases and Expressions

anti-interference capability: 抗干扰能力

is displayed directly: 被直接显示

inserted into: 插入……

corresponding measuring range: 对应量程

Notes

(1) Multimeter, also called Universal Meter, is a kind of measuring instrument with multi-function and multi-range.

整个句子是主系表结构。主语是 Multimeter，系动词是 is，表语是 instrument。with multi-function and multi-range 是伴随状语。

(2) The readout is intuitive and visual.

这句话是主系表结构。主语是 The readout，系动词是 is，表语是 intuitive and visual。

(3) As a result, digital multimeter has been rapidly popularized and widely used, and it is gradually replacing the traditional pointer multimeter.

这句话是现在完成式的被动语态。has been rapidly popularized and widely used 中，and 连接两个并列的成分：rapidly popularized 和 widely used，and 前面省略了同样的成分 has been，补充完整后应是 “has been rapidly popularized and has been widely used”。

6.3B



Oscilloscope

Oscilloscope is a widely used electronic measuring instrument. It can transform invisible electrical signals into visible images. We can use the oscilloscope to observe the signals curves of different waveform, amplitude changes overtime, and we can also use it to test various electric quantities, such as voltage, current, frequency, phase difference, amplitude modulation and so on. Any periodic physical process that can be transformed into an electrical effect can be observed directly by the display screen of an oscilloscope.

According to the different techniques used in measurement, oscilloscope can be divided into two categories: analog oscilloscope and digital oscilloscope.

The analog oscilloscope generates the electron beam according to the test signal and emits the electron beam onto the screen with the electron gun. The inner surface of the screen is coated with fluorescent material, and the spot hit by the electron beam will glow. The electron beam will “draw” the waveform curve of the instantaneous value of the measured signal on the screen like a pen. It works almost the same way as an old-fashioned cathode ray picture tube TV (Figure 6-7).



Figure 6-7 Old-fashioned Cathode Ray Picture Tub TV

Digital oscilloscope is a kind of high performance oscilloscope which is manufactured by a series of technologies, such as data acquisition, A/D conversion, software programming and so on. The digital oscilloscope operates by converting the measured voltage to digital information through the analog-to-digital converter (ADC). The digital oscilloscope captures a series of sample values of the waveform and stores the sample values, the storage limit is to determine whether the accumulated sample values can describe the waveform or not. Then the digital oscilloscope reconstructs the waveform. Digital oscilloscope can be divided into digital storage oscilloscope (DSO), digital phosphor oscilloscope (DPO) and sampling oscilloscope.

For most electronic applications, analog oscilloscope (Figure 6-8) and digital oscilloscope (Figure 6-9) are competent. The performance upgrade of analog oscilloscope needs to improve the bandwidth, and the full advance of oscilloscope tube, vertical amplification and horizontal scanning. If we want to change the bandwidth of digital oscilloscope, we only need to improve the performance of the front section A/D converter, and there is no special requirement for



Figure 6-8 Analog Oscilloscope

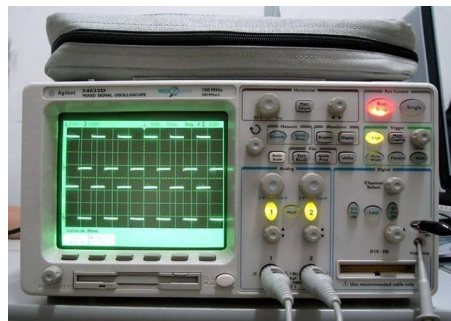


Figure 6-9 Digital Oscilloscope

oscilloscope and scanning circuit. In addition, digital oscilloscope tube also has the ability to make full use of memory, storage and processing, as well as a variety of triggers and leading triggers. Since the 1980s, digital oscilloscope has sprung up and results are numerous. The analog oscilloscope has the potential to be replaced by digital oscilloscope completely, and it will retreat from the foreground to the background soon.

6.4A



Twisted-pair Tester

A twisted-pair wire is the most widely used network medium in the computer network at present. It can be used to connect multiple computers to a network switch to form an Ethernet.

The process of making a twisted-pair jumper is as follows:

First, peel the outer skin of a twisted-pair wire, and then arrange the eight wire cores of a twisted-pair wire (orange white, orange, green white, blue, blue white, green, brown white and brown) according to the color sequence shown in Figure 6-10. Then insert a crystalhead shown in Figure 6-11. At last, as shown in Figure 6-12, put the inserted crystal head into crimping pliers and press it hard.

How to test whether the cable is made successfully? The instrument shown in Figure 6-13 is called a twisted-pair tester. Insert the crystal heads at both ends of the cable into the network interface of a tester respectively. As long as the eight indicator lights on both sides of a tester

are flashing synchronously in turn, the jumper manufacturing is successful. This jumper can be used to connect a computer to computer networks. If any light is not on, this represents that the corresponding wire core is not connected. If the lights on left and right sides are not flashing synchronously, this represents that the order of your wiring is not correct and the network connected with this wire will not work properly.

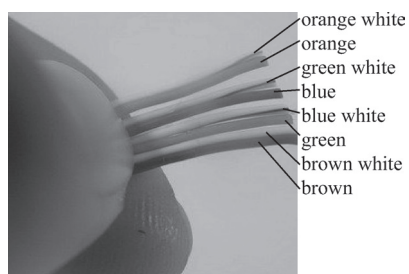


Figure 6-10 Sorting

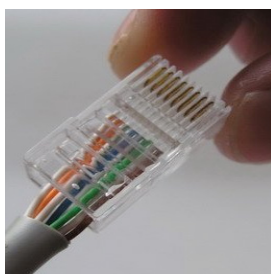


Figure 6-11 Insert the crystal head



Figure 6-12 Use the crimping plier



Figure 6-13 Test make-and-break by the twisted-pair tester

New Words

wire ['waɪə(r)]n. 电线；金属丝

widely ['waɪdli]adv. 广泛地；普遍地；到处；大量地

medium ['mi:diəm]adj. 中等的，中级的；普通的

n. 媒介

multiple ['mʌltɪpl] adj. 多重的；多个的；复杂的；多功能的

jumper ['dʒʌmpə(r)] n. 跳高运动员，跳跃者；[电] 跳线，跨接线

peel [pi:l] vt. 剥皮；覆盖层脱落，剥落

vi. 剥落；脱落

arrange [ə'reɪndʒ] vt. 整理；把……（系统地）分类；改编

sequence ['si:kwəns] n. 顺序；[数] 数列，序列；连续

crystal ['krɪstl] n. 晶体；水晶；结晶（体）；水晶饰品

adj. 水晶的；水晶般的

figure ['fɪɡə(r)] n. 人物；数字；身材；算术

vi. 计算

shown [ʃəʊn] v. 表现出；给……看（show 的过去分词）；显露出；上演

crimp [krɪmp] v. 压接；使（头发）卷曲

plier ['plaɪə] n. 手钳；夹钳；钳子，老虎钳

instrument ['ɪnstrəmənt] n. 仪器；乐器；手段，工具

Phrases and Expressions

at present: 目前，现在；时下；现下；此时

be used to: 适用于

as follows: 列举如下

according to: 根据，按照；据……所说；如；比照

Notes

(1) How to test whether the cable is made successfully?

How to test → How 引导特殊疑问句，表示“如何”→“如何测试”。

whether the cable is made successfully → whether 引导宾语从句，表示“是否”→“是否线缆被成功制作”→“线缆是否制作成功”。

(2) As long as the eight indicator lights on both sides of a tester are flashing synchronously in turn, the jumper manufacturing is successful.

As long as the eight indicator lights on both sides of a tester are flashing synchronously in turn → 这部分是条件状语从句，整个句子是主 + 系 + 表结构。主语是 manufacturing，系动词是 is，表语是 successful。

(3) If the lights on left and right sides are not flashing synchronously, this represents that the order of your wiring is not correct and the network connected with this wire will not work properly.

If the lights on left and right sides are not flashing synchronously 为由 If 引导的条件状

语从句，表示“如果……”→如果灯在左右两边没有闪亮同步地→如果左右两边的灯没有同步闪亮。

this represents → this 指代条件句中的情况→“则代表”。

this represents that the order of your wiring is not correct 为由 that 引导的宾语从句，作为 represents 的宾语→这代表你接线的顺序是不对的→这代表你接线的顺序发生了错误。

and the network connected with this wire will not work properly → and 连接的是并列的宾语从句→网络被用这个线连接不会工作，正常地→用这个线连接的网络不会正常工作。

6.4B



A More Professional Cable Tester——Fluke1800

Does a cable that can be connected and tested by a twisted-pair tester has to meet the standards of the computer network industry? No! For network media, the computer network industry has more strict standards, and requires more sophisticated instruments to measure. The thing to learn today is the more professional cable tester Fluke1800, as shown in Figure 6-14.



Figure 6-14 Fluke1800

Fluke has created and developed a specific technology market that provides quality testing and trouble shooting products for various industrial sectors and elevates the market to a significant level. Testing products in the computer network industry are just one part of its vast business. It is headquartered in Everett, Washington, with its factories located in the

United States, the United Kingdom, the Netherlands and China. Its sale and service branches are located in more than 100 countries around the world.

The testing object of Fluke1800 is not only a network cable, but also a complete data link. The network medium it tests is not only a twisted pair of wire, but also an optical fiber.

The first category of Fluke1800 testing items is the “wiring diagram”, which shows the connection status of the eight cores in the twisted pair cable. The wiring diagram has six forms: normal, open circuit, short circuit, broken circuit, cross connection (Figure 6-15), and string winding. Only the first form represents the correct wiring diagram.



Figure 6-15 Error status (cross-connection)

The second category of Fluke1800 testing items is “electrical parameter”. There are dozens of parameters to be tested. Some of the most common items are attenuation, insertion loss, echo loss, near-end crosstalk and so on. Figure 6-16 shows the test result for insertion loss. The insertion loss is the energy loss caused by inserting of a cable connector into the network interface. The near-end crosstalk is the interference of one pair of twisted pair of wire cores to the other pair of wire cores.

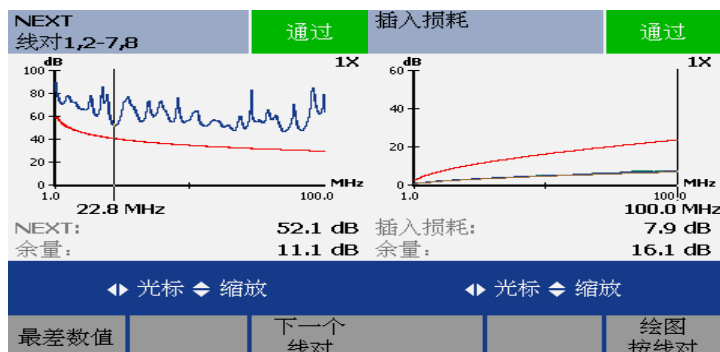


Figure 6-16 Insertion loss

In a word, for the acceptance of a network project, every data link has to be tested by the instrument to get dozens of parameters. So long as one of the parameters is unqualified, the project will not be able to pass the project acceptance smoothly.

Unit 7

Modern Communications

7.1



Mo-tse Quantum Communication Satellite

Modern communication has always been troubled by the problems of information security. Quantum communication is the brightest pearl in the crown of modern communication technology because it completely solves the security problems of information transmission.

The working principle of quantum communication satellite is communicate using quantum entanglement. Quantum entanglement is a quantum mechanical phenomenon. No matter how far the distance is, a pair of elementary particles (such as photons) in a quantum entangled state will change, if one of them changes the state, the other must change accordingly. This quantum entanglement is an instantaneous effect across distances. The enemy has no chance of intercepting, listening and cracking. Therefore, quantum communication solves the security problems of information transmission completely.

In 2001, Chinese scientist Pan Jianwei and his colleagues came up with the initial idea of establishing a “world integrated” quantum communication network. In 2003, Pan Jianwei’s team prepared pairs of entangled photons. Quantum communication was accomplished by distributing the pair of photons to two places 13 km apart.

In 2011, the Chinese Academy of Sciences officially launched the development of the world’s first “Quantum Science Experimental Satellite”.

In 2012, Pan Jianwei and others successfully realized the quantum teleportation and entanglement distribution in free space at the magnitude of 100 km for the first time in the world.

At 01:40 on August 16th, 2016, China successfully launched China’s first quantum science experimental satellite “Mo-tse” at Jiuquan Satellite Launch Center with a long

March 2 carrier rocket and successfully put it into orbit. This makes China the first country in the world to achieve quantum communication between space and ground. The quantum communication technology of our country has finally caught up from behind, reaching the leading level in the world.

Mo-tse was a famous thinker in the history of China. He first proposed that light spread along a straight line and designed the small hole imaging experiment. We named the world's first quantum communications satellite "Mo-tse" in honor of his great contribution.

On January 18th, 2017, "Mo-tse" successfully completed a four-month on-orbit test mission, being formally delivered to user units for use. On June 16th, "Mo-tse" realized the quantum entanglement of 1000 km for the first time. On August 12th, "Mo-tse" successfully realized the satellite-earth two-way quantum communication at the scale of 1000 km. So far, "Mo-tse" Quantum Satellite has successfully completed the three predefined scientific objectives ahead of schedule.

In January 2018, the intercontinental quantum key distribution (Figure 7-1) with a distance of 7600 km was realized for the first time between China and Austria, and the encrypted data transmission and video communication were realized by using the shared key. This achievement marks the ability of "Mo-tse" to implement intercontinental quantum secure communication.

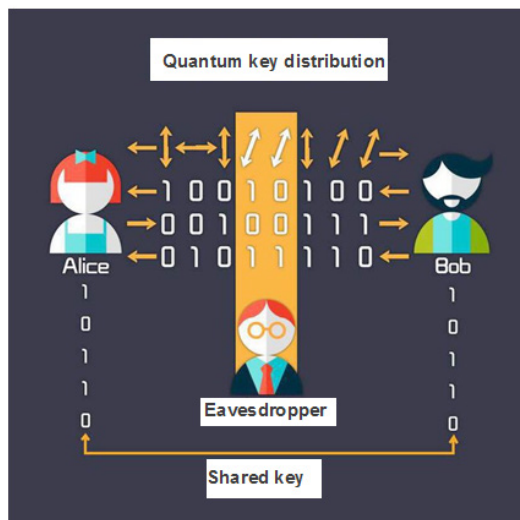


Figure 7-1 Quantum key distribution

China's Mo-tse Quantum Communication Satellite has created a world pioneer and is the pride of the Chinese people. It will bring great influence to the defense, finance, commerce and other fields of the world. In the next step, China also plans to launch "Mo-tse 2" and "Mo-tse3" satellites in order to establish the first global quantum communication network around 2030.

7.2A



BeiDou Navigation Satellite System

GPS has become the lifeblood of every industry in modern society. Without GPS, military combat systems would be paralyzed, transportation systems would be paralyzed, bulk deals would not be possible, and geophysical research would be stalled. As an important weapon, it has become the norm for the United States to interfere with the weapon systems of hostile countries by interfering with GPS signals. Fortunately, China also has its own GPS——BeiDou Satellite Navigation System (Figure 7-2).



Figure 7-2 Navigation satellite

The first BeiDou system, officially called the BeiDou Satellite Navigation Test System and also known as BeiDou-1, consists of three satellites which had offered limited coverage and navigation services, mainly for users in China and neighboring regions from 2000 to the end of 2012.

The second generation of the system, officially called the BeiDou Navigation Satellite System (Figure 7-3) consists of 10 satellites in orbit. Since December 2012, it has been offering services to customers in the Asia-Pacific region.



Figure 7-3 BeiDou Navigation Satellite System

In 2015, China started the build-up of the third generation BeiDou system (BeiDou-3) in the global coverage. In 2016, it was claimed that BeiDou-3 would reach millimeter-level accuracy (with post-processing), which is ten times more accurate than the finest level of GPS. Until February 12th, 2018, 29 BeiDou satellites had been launched. China is expected to build a global BeiDou Satellite Navigation System which will eventually consist of 35 satellites around 2020.

New Words

lifeblood ['laɪfbld] n. 命脉; 生命线; 命根子; [文] 血液

military ['mɪlətri] adj. 军事的；军用的；好战的

n. 军队；军人

paralyze ['pærəlaɪz] vt. 使瘫痪，使麻痹；使不能正常活动

hostile ['hɒstaɪl] adj. 敌人的，敌对的；不利的

n. 敌方；敌对者

navigation [ˌnævɪ'geɪʃn] n. 航行；航海；海上交通，导航

satellite ['sætəlaɪt] n. 卫星；人造卫星；

v. [传播] 通过通信卫星播送

officially [ə'fɪʃəli] adv. 正式地；官方地；公务上

coverage ['kʌvərɪdʒ] n. 范围，规模；保险项目；（新闻）报导；

eventually [ɪ'ventʃʊəli] adv. 终究；终于，最后；竟；总归

Phrases and Expressions

GPS: Global Position System: 全球定位系统

consist of: 包括；由……组成

the Asia-Pacific region: 亚太地区

Notes

(1) The first BeiDou system, officially called the BeiDou Satellite Navigation Test System and also known as BeiDou-1, consists of three satellites which had offered limited coverage and navigation services, mainly for users in China and neighboring regions from 2000 to the end of 2012.

整个句子中，主语为 The first BeiDou system，谓语为 consists of，句子主体结构为“The first BeiDou system consists of three satellites”。

(2) In 2015, China started the build-up of the third generation BeiDou system (BeiDou-3) in the global coverage.

China started the build-up of the third generation BeiDou system (BeiDou-3) → 中国开始建设第三代北斗系统；in the global coverage → 在全球范围 → 覆盖全球范围的。

(3) In 2016, it was claimed that BeiDou-3 would reach millimeter-level accuracy (with post-processing), which is ten times more accurate than the finest level of GPS.

it was claimed that BeiDou-3 would reach millimeter-level accuracy (with post-processing) → it 作为形式主语，真正的主语是一个句子 (that BeiDou-3 would reach millimeter-level accuracy) → 官方宣称北斗 3 达到毫米级精度（处理后）。

is ten times more accurate than → 比……更精确 10 倍。

the finest level of GPS → 最高精度的 GPS。

which is ten times more accurate than the finest level of GPS → 这比最高精度的 GPS 精确 10 倍 → 逗号后面的 which 引导的是一个非限定性定语从句。

7.2B



Global Positioning System

The Global Positioning System (GPS) of the United States is a global satellite system which consists of 24 satellites. The system can ensure 4 satellites can be observed simultaneously at any time and place on the earth, and ensure that the satellite can collect the longitude, latitude and altitude data from the observation point, in order to achieve high precision navigation and positioning, timing as well as other functions.

GPS began in 1958 as a project of the United States military. It was put into use in 1964. In the 1970s, the United States Army, Navy and Air Force jointly developed a new generation of GPS satellite positioning system. The main purpose is to provide real-time, round-the-clock and global navigation services for land, sea and air, and for some military purposes such as intelligence gathering, nuclear explosion monitoring and emergency communications. It is an important part of America's global strategy of hegemony.

Since the 1980s, GPS has been allowed global commerce. GPS can work independently of any telephone network or the Internet. Any GPS receiver has free access to the system, which provides great convenience to users around the world. Let's take a look at what would happen if there were no GPS today.

(1) A large number of vehicles, ships and aircraft equipped with GPS navigation systems would be disoriented.

(2) Logistics systems would collapse and fail to track important vehicles and goods transport.

(3) The military command system would be out of order and the precision guided missile could no longer be guided.

(4) The whole Internet of Things industry would collapse.

.....

The conclusion is that we are now inseparable from GPS technology.

For some purpose, the United States deliberately added jamming signals to GPS satellite

civil channels to reduce its accuracy. But in May 2000, Bill Clinton, the President of the United States of the time, ordered the cancellation of the interference. The first reason was that the monopoly position of GPS would not be challenged in the short term. Second, it showed the confidence of the United States in its own technology. The US had the ability to jam GPS signals in a particular area to prevent the enemy from using GPS and to protect the ability of its own military to use GPS.

For their own strategic security, countries all over the world are doing their best to develop satellite positioning systems. Russia launched its global navigation satellite system (GLONASS) program in 1982, with a total of 24 satellites expected to be launched. The Galileo satellite navigation system is a global satellite navigation and positioning system developed and established by the European Union. By December 2016, 18 working satellites had been launched, and all 30 satellites were scheduled to be launched by 2020. India's regional navigation satellite system NAVIC, because of its limited technical capacity, currently covers India and Pakistan. The three main functions of QZSS of Japan's Quasi zenith satellites navigation system are GPS system supplements, GPS system precision enhancement and warning service. At present, China's Beidou satellite navigation system has been developed to the third generation, as of February 12th, 2018, a total of 29 Beidou satellites have been launched. The number of launched Beidou satellites is expected to reach 35 by 2020, when China will build a more accurate global navigation satellite system covering the world than GPS.

7.3A

5G Era



5G is the fifth generation mobile communication. From the first generation, analog communication system, to the fourth generation(4G) communication technology, the communication quality and rate are greatly improved, and the 1080P HD video program can be viewed smoothly online now.

What can 5G do?

5G has great throughput. It has three features: extremely high speed, maximum capacity and very low delay. The rate of 5G network is about 100 times higher than that of 4G network. Therefore, the download speed of the 5G network can reach 1~10G per second. An HD movie of 4G can be downloaded in about 1 second under the 5G network.

5G will open the age of interconnection of all things. Our life will become a real smart life of “leading an easy life, with everything provided”. For example, in the morning, your pillow, quilt, or bed wake you up from your sleep in a more natural way. Then it opens the curtains and turns on the lights needed in the room.

The main features of the 5G network are: unparalleled speed, no problem with more people, communicating everything, both real-time and reliable and excellent experience. The changes brought about by the 5G network are far more than that; smart cities, smart grids, intelligent grazing/planting, real-time logistics tracking, remote driving, auto driving of car networking, and fully automatic industrial control are all likely to come along with the 5G era (Figure 7-4).

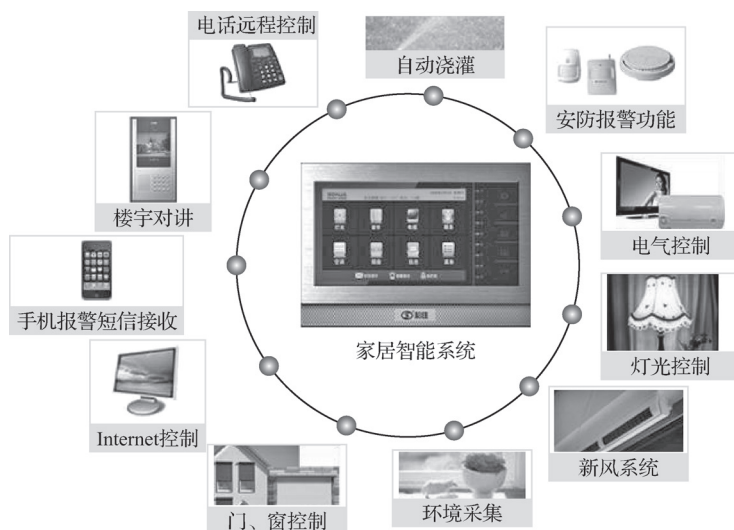


Figure 7-4 Interconnection of Everything

New Words

communication [kəˌmjuːnɪˈkeɪʃn] n. 交流；通信

smoothly ['smuːðli] adv. 顺利地；平稳地；流畅地

extremely [ɪk'striːmli] adv. 极端地；非常，很

interconnection [ˌɪntəkəˈnekʃn] n. 互相连络

pillow ['pɪləʊ] n. 枕头；垫子

vt. 搁于枕上

vi. 以……为枕

quilt [kwɪlt] n. 被子，棉被

v. 缝（被）；东拼西凑地

curtain ['kɜːtn] n. 窗帘；幕；覆盖物

unparalleled [ʌnˈpærəleɪd] adj. 空前的；无比的，空前的

grid [grɪd] n. 格子；（输电线路、天然气管道等的）系统网络

logistics [ləˈdʒɪstɪks] n. 物流；后勤；逻辑学；组织工作

Phrases and Expressions

analog communication system: 模拟通信系统

unparalleled speed: 无与伦比的速度

smart grids: 智能电网

Notes

(1) The rate of 5G network is about 100 times higher than that of 4G network.

句中 higher than → “比……高”。

(2) The changes brought about by the 5G network are far more than that; smart cities, smart grids, intelligent grazing/planting, real-time logistics tracking, remote driving, auto driving of car networking, and fully automatic industrial control are all likely to come along with the 5G era.

整个句子是主 + 系 + 表结构。主语为 The changes，系动词为 are，表语为 all likely to come along。句子主体结构为：The changes are all likely to come...

7.3B



All-Optical Network

The development of modern communication network has experienced the first generation of cable network, the second generation of photoelectric hybrid network, and has developed to the third generation of all-optical network. The so-called all-optical network refers to the signals that realize electricity-to-light and light-to-electricity conversion only on the terminal devices, but they are always transmitted at high speed in the form of optical waves in the process of transfer and exchange in the network.

1. Basic structure of all-optical network

Terminal devices like computers and mobile phones around us use electrical signals to process information. The terminal devices need to convert their generated electrical signals into optical signals and enter the “optical fibers” (Figure 7-5) to complete the signal transmission (“Transmitter” and “Receiver” in Figure 7-6 are the working modules of the photo electric converter).

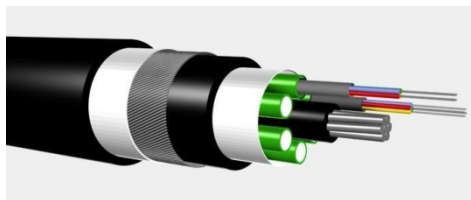


Figure 7-5 Optical fiber cable

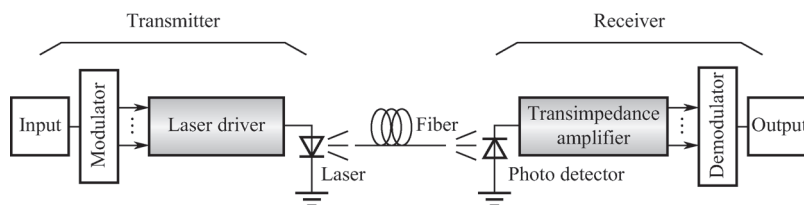


Figure 7-6 Optical communication system

2. Main features of all-optical network

1) High transmission rate

The current copper cable network broadband speed can generally reach tens of megabytes per second, which may be a bit faster in the future. But the copper cable network has some insurmountable problems, such as serious interference, high cost and easy aging. The optical fiber network can easily realize the connection between gigabit network and 10 gigabit network, without the disadvantages of copper cable.

2) Long transmission distance

If the traditional copper cable network is used, a relay station will need to be established in the distance of hundreds of meters for signal relaying. But the current fiber optic network (telecommunication backbone network) usually needs to relay after dozens of kilometers.

3) Low material cost

The long distance single mode fiber is generally made of glass fiber, and its main component is silicon dioxide, which is cheap and environmental. In the last kilometer network access section, the passive optical network (PON) access technology is widely used, which simplifies the line structure and saves the cost.

4) Good confidentiality

The transmission of optical waves in optical fiber will not emit electromagnetic wave like copper cable network, so its confidentiality performance is excellent.

At the same time, all-optical network has the advantages of small volume, light weight, simple structure, easy to upgrade and convenient installation of optical cable and so on.

The technology of all-optical communication network is the frontier technology in the field of optical fiber communication, which is the real highway in the 21st century. In many countries, all-optical networks is used as the basis for the construction of “information super highway” and has been elevated to a strategic position.

In September 2001, Shanghai first opened the all-optical communication network nationwide. In September 2015, Sichuan became the first “All-optical Network Province” in China. In 2016, the number of newly-built optical cables in China reached a new high of 5.54 million kilometers, and the total length of the installed optical cable line reached 30.41million

kilometers, ranking among the forefront of the world.

In 2017, China proposed and implemented policies such as the “Broadband China” “Improving internet speed and lowering prices”, which has vigorously promoted the construction of all-optical network in China.

7.4A



Unified communication

Unified communication (Figure 7-7) is a combination of all types of information, such as voice, video, fax, voice mail, e-mail, mobile text messages and data. People can use any device at anytime or anywhere through any network or any method, in the shortest time with the right person in the most correct way to realize the free communication of data, voice and video.

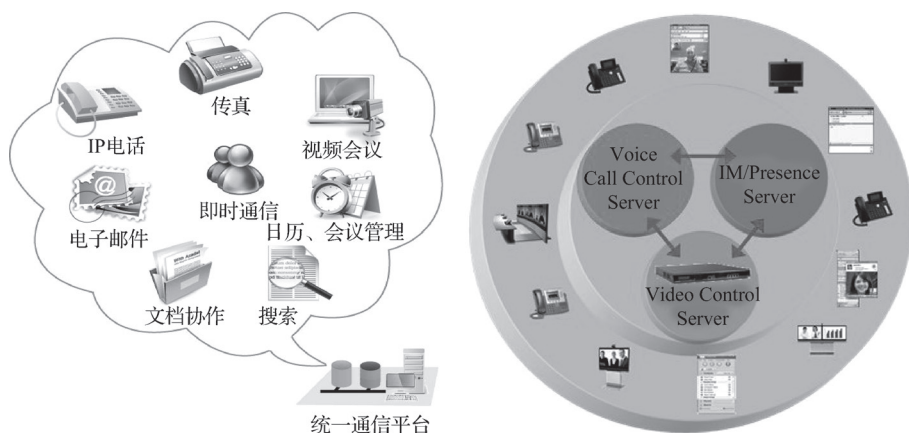


Figure 7-7 Unified communication

Unified communication has the following main advantages:

(1) One key login. Requiring only SoHoMo client to login, the multiple functions can be realized on the interface, without frequently logging in multiple systems.

(2) IP-based voice calls are provided to support enterprise branches to dial each other through short numbers. It doesn't need to pass through the operator network, saving a large amount of communication costs for enterprises.

(3) Employee information maintenance is more convenient. On the client interface, the communication mode of any employee in the enterprise can be inquired, and the employee information is updated in real time, fast, efficient and convenient.

(4) The communication mode is unified and the information is more secure. It provides unified instant messaging and mailbox tools, so enterprise employees can communicate with each other. Employees cannot send documents or mails to the external network, therefore, the internal security of the enterprise is guaranteed.

(5) Reduce the risk of enterprise communication system virus. The communication mode is unified and the information is more secure.

New Words

communication [kə,mju:nɪ'keɪʃn] n. 交流；通信；书信；传达

fax [fæks] n. 传真

vt. 传真；传真传输

advantage [əd'vɑ:ntɪdʒ] n. 优势；优越（性）

vt. 有利于；有益于

vi. 得益，获利

multiple ['mʌltɪpl] adj. 多重的；多个的；复杂的；多功能的

enterprise ['entəpraɪz] n. 企（事）业单位；事业，计划；进取心

maintenance ['meɪntənəns] n. 维护；维修；维持，保持；保养，保管

employee [ɪm'plɔɪi:] n. 雇工，雇员，职工

document ['dɒkjumənt] n. 公文；〔计算机〕文档，证件

vt. 记录；证明

risk [rɪsk] n. 危险，冒险；保险额

vt. 使……冒风险（或面临危险）

update [ʌp'det] vt. 更新，使现代化；校正，修正

n. 现代化

virus ['vaɪrəs] n. 病毒；病毒性疾​​病；毒素，毒害；〔计算机〕计算机病毒

Phrases and Expressions

Unified Communication: 统一通信

SoHoMo: smart office, home office and mobile office 的简称

instant messaging: 即时通信

Notes

(1) Requiring only SoHoMo client to login, the multiple functions can be realized on the interface, without frequently logging in multiple systems.

SoHoMo 是 smart office, home office and mobile office 的简称；to login 为不定式短语作为目的状语→需要只一个 SoHoMo 客户端去登录→只需登录 SoHoMo 一个客户端。

(2) It doesn't need to pass through the operator network, saving a large amount of communication costs for enterprises.

It doesn't need to pass through the operator network → need 为实义动词，后跟带 to 的不定式→它不需要通过运营商网络→无需经过运营商网络。

saving a large amount of communication costs for enterprises → saving 是现在分词，表伴随；a large amount of 译为“大量的”；costs 译为“成本，费用”→节省大量的通信成本为企业→节省企业大量通信费用。

(3) It provides unified instant messaging and mailbox tools → it 指代“unified communication”即“统一通信”，在上下文背景清楚的情况下，翻译时可以不译→提供统一的即时消息和邮箱工具。

7.4B



Internet Communication

Network communication is to connect the isolated devices through the network, and realize communication between people and people, people and computers, computers and computers through information exchanges.

Like all technologies (especially those involving the Internet), methods of online communication are also evolving. In recent years, the main ways of Internet communication include instant messaging (Figure 7-8), E-mail (Figure 7-9), online calls (Figure 7-10), network phones, video conferences (Figure 7-11), SMS and wireless communications, etc.

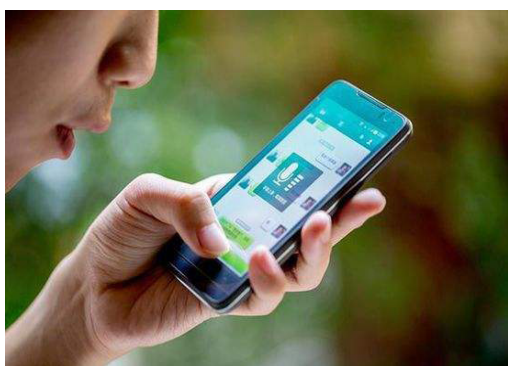


Figure 7-8 Instant messaging



Figure 7-9 E-mail



Figure 7-10 Online calls



Figure 7-11 Video conferencing

Internet communication has a lot of advantages. As long as you have paid for the Internet, you can save the cost of making the regular call by sending instant messages or using

a network IP phone. Of course, no technology is flawless, and network communication has many disadvantages, such as virus, leaking and spam.

Instant messaging can be regarded as a computer text conference between two or more people. Instant messaging servers can create personal chat rooms which allow you to chat with another person online in real time. General instant messaging systems also have a reminder function: it will remind you when your friends or contacts are online, and then you can start chatting with someone.

Online calls are made up of hardware and software. You can use the Internet as a transmission medium for the phone. Internet phone software provides free calls to all parts of the world for users who already have free or fixed billing (for example, monthly or yearly payment).

E-mail is transmitted through a communication network. With an e-mailbox, you can send e-mail. You can e-mail someone only if you know his e-mail address. An e-mail usually takes a few seconds to reach its destination. E-mail can send messages or send files to a group of people (Mass texting). This is a particularly effective way to communicate with a group of people.

Video conferencing refers to a meeting through the method that two or more people who are not in the same place meet together to transmit voice and video data through a computer network. Each participant has a video camera, microphone and speaker connected to the computer. When two participants speak to each other, their voices are sent to each other through the network. Images taken by one side of the camera are displayed on the other side of the computer screen.

All these Internet communication methods make people's lives and work faster, more convenient and economical.

Unit 8

Intelligent Manufacturing

8.1



Escort the Pillars of a Great Power——CNC Maintenance Expert Hu Minghua

Tech geek is a buzz word to describe talents whose daily lives can be highly integrated with their vacations or skills in reality. Hu Minghua has been a tech geek for nearly 20 years. Hu Minghua graduated from Sichuan Engineering Technical College in 1994 and stayed for teaching after graduation. As deputy director of the Intelligent Control Institute of Sichuan Engineering Technical College, Hu Minghua's another identity is the master of diagnosis and treatment for advanced CNC equipment control parts. He is quite skilled at revitalizing the damaged control elements of CNC equipment which were paralyzed or declared dead. In 2018, Hu Minghua was awarded the "Sichuan craftsman" title.

Hu Minghua's blockbuster started in 2008. After the *Wenchuan Earthquake* on May 12th, 2008, Hu Minghua guided a technical service team with 13 teachers and students to support the reconstruction in the earthquake zone. For more than a month, risking the aftershocks, they repaired more than 50 CNC for Dongfang Steam Turbine Co., Ltd. which were worth nearly 100 million yuan (Figure 8-1).

"Rome is not built in one day". Before 2008, Hu Minghua had studied assiduously for nearly 10 years.

Deyang, the city in which Hu Minghua works and China's major equipment manufacturing base, has owned 1400 equipment manufacturing enterprises represented by China Erzhong, Dongfang Electric Corporation, Dongfang Steam Turbine Co., Ltd. Hu Minghua has gradually become an "old acquaintance" of these enterprises. He has successively provided more than 500 times of technical services for the maintenance and

renovation of numerical control equipment for various enterprises and institutions, and created a maintenance value of more than 7 million yuan. He has solved many major technical problems of maintenance for key equipments, such as the large scale driving device of Erzhang 80,000 tons heavy forging machine, the DIXI 1200JIG high precision CNC machine tools spindle drive system of Institute of Optics and Electronics, Chinese Academy of Sciences. Among them, only the maintenance of 80,000 tons forging machine driving device saved about 2 millions yuan for Erzhang Plant.



Figure 8-1 Hu Minghua's team in earthquake zone

Hu Minghua treats each repair as a valuable anatomy lesson during the cooperation with enterprises. In order to repair a Dutch HGG interline cutting machine with frequent faults, he placed the equipment directly beside his bed, switched on the electricity and observed it day and night. “One morning, I suddenly saw a red light flashing on the circuit. It might only be a few tenths of a second and then it went out.” That fleeting moment was caught by Hu Minghua. Following this clue, he finally found a fault in the component and solved the problem that foreign experts failed to deal with. “In fact, the cost of that component is only 0.5 yuan.” Hu Minghua said.

With constant research, Hu Minghua and his team got into the field of renovation and development from maintenance. In the cooperation with a zipper manufacturer, Hu Minghua successfully developed an advanced complete set of zipper dyeing products and raised the success rate of zipper dyeing by 4 times. Meanwhile, the dyeing equipment that he developed has exported to USA and other developed countries.

Hu Minghua said: “Only in the way of producing core components domestically and mastering key technology, we will not be controlled by others at the critical moment. We hope that we will master the maintenance technology for core high-end equipment in our own hands with great efforts, and escort the national heavy equipment manufacturing enterprises.”

While studying technique continuously, Hu Minghua has paid great attention to the training of skilled talents. He has introduced students to join the technical team and made them growing up in practice. He sets up a mechanism of passing, helping, leading in the team, and has trained and guided students to participate in various competitions. The model of combination of production, learning and research has made students grow up quickly.

8.2A



Industry 4.0

Industry 4.0 is the fourth industrial revolution led by intelligent manufacturing (Figure 8-2). It is a high-tech strategic plan proposed by the German government in April 2013. Its core is to make supply, manufacturing and sales information digitalized and intelligent by means of Cyber-Physical System (CPS). It aims to establish a highly flexible production mode of personalized and digital products and services.

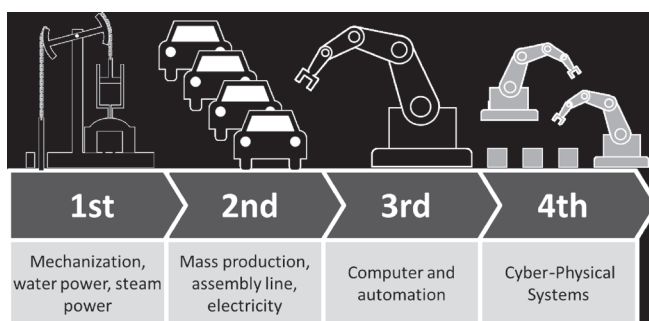


Figure 8-2 The industrial revolutions and the future vision

The “Industry 4.0” project is mainly divided into three themes:

The first is the Smart Factory. It focuses on the study of intelligent production systems and processes. The goal is to achieve unmanned production sites, networked production equipment, visualized production data and transparent production processes.

The second is the Intelligent Production. It mainly involves the revolution of the entire enterprise's production process. One is automation of production resource allocation; the other is automation of process operation (including material transfer, production and processing, etc.).

The third is the Intelligent Logistics. It is mainly through the Internet, the Internet of Things, the logistics network to integrate the logistics resources and give full play to the efficiency of the existing logistics resources suppliers, so the demanders can quickly obtain their matching service and logistics support.

Germany announced Industry 4.0, the United States developed the Industrial Internet, and China proposed the inspiring "Made in China 2025". All countries in the world are trying to seize the first opportunity in the fourth Industrial Revolution.

New Words

revolution [ˌrevəˈluːʃn] n. 革命; 旋转

manufacturing [ˌmænjuˈfæktʃərɪŋ] n. 制造业, 工业

adj. 制造业的, 制造的

v. 加工

strategic [strə'ti:dʒɪk]adj. 战略性的；战略（上）的；有战略意义的；至关重要的

digitalize ['dɪdʒɪtəlaɪz]v. 数字化

cyber ['saɪbə] adj. 计算机（网络）的，信息技术的

flexible ['fleksəbl]adj. 灵活的；柔韧的

visualized ['vɪʒʊəlaɪzd] adj. 直观的

transparent [træns'pærənt] adj. 透明的；显而易见的

enterprise ['entəpraɪz] n. 企（事）业单位；事业

allocation [ˌælə'keɪʃn] n. 配给，分配

logistics [lə'dʒɪstɪks] n. 物流；后勤；逻辑学

integrate ['ɪntɪɡreɪt] vt. 使一体化；使整合

vi. 成为一体

inspiring [ɪn'spaɪərɪŋ] adj. 鼓舞人心的；激励的

vt. 激励

Phrases and Expressions

Cyber-Physical System: 信息物理融合系统；物理系统

production mode: 生产模式；生产方式

Notes

(1) It is a high-tech strategic plan proposed by the German government in April 2013.

high-tech strategic plan 译为“高科技战略计划”。proposed 是 propose 的过去分词形式，表示被动；proposed by 译为“被……提出”→“由……提出”。

(2) The goal is to achieve unmanned production site, networked of production equipment, visualized of production data and transparent of production process.

The goal is to achieve 是主系表结构，the goal 是主语，is 为系动词，用于连接主语和表语；to achieve 是不定式充当的表语，意思是目标达到或实现。transparent of production process 译为“透明的生产过程”。

(3) It is mainly through the Internet, the Internet of Things, the logistics network to integrate the logistics resources and give full play to the efficiency of the existing logistics resources suppliers, so the demanders can quickly obtain their matching service and logistics support.

It is mainly through the Internet, the Internet of Things, the logistics network → 该部分构成主系表结构，由主语 + 系动词 + 介词短语构成，译为“主要通过互联网、物联网、物流网”。to integrate the logistics resources 为不定式 to do 结构，在句子里充当目的状语，译为“整合物流资源”，give full play to 译为“充分发挥”。

8.2B



Smart Factory

The smart factory (Figure 8-3) is the further revolution of the modern factory informatization. It mainly uses the technology of Internet of things and equipment monitoring technology to control the production process. It can clearly control the entire production process, improve the controlability of the production process, reduce the manual intervention on the production line, collect the production line data immediately and correctly, and arrange production plan and production schedule reasonably at the same time.



Figure 8-3 Smart Factory

The smart factory is an important carrier to realize intelligent manufacturing. While realizing the intelligentization of production process, it also helps enterprises realize the business model of end to end (consumer to producer) by building a humanized factory with high efficiency, energy saving, green environmental protection and comfortable environment.

The smart factory will meet customers' personal needs to the maximum extent. For example, you need to customize a personalized car with a special color or electric heating seat and so on (the current production mode is not possible to achieve this level of personalized production). You can send the order directly to the manufacturer via your mobile phone. The production system will automatically generate the solution from the database and sends it to the production line control system.

In car assembly shop, the engine, seats, windows and so on are transported to the production line along with the conveyor belt. All of these parts have "customized information" radio frequency identification codes that methodically "tell" the production equipment "who

I am” “how to deal with me” and “where I am going”. The robots scan and recognize their messages, “wake up” from “a deep sleep”, and begin assembling until the car is finished.

Siemens’s Amberg Electronics Plant (Figure 8-4) of Germany is making this a reality. The Amberg plant, which was founded in 1989, now produces about 15 million Simatic products a year. In order to collect accurate data, more than 300 million components of the Amberg plant have their own identity cards. The basic identification information includes: which line is produced, what material is used, what torque is used at that time, and what kind of screw is used and so on. When a component enters the oven, the machine will determine the temperature and time to take, and can determine which component is the next to enter the oven, and adjust the production parameters at the right time. During this process, the Simatic IT production execution system will generate and store about 50 million pieces of production process information per day.



Figure 8-4 Siemens’ Amberg Electronics Plant

In the electronic manufacturing plant of Amberg, the real factory runs synchronously with the virtual factory. The data parameters and the production environment of the real factory are reflected through the virtual factory, while workers will control the real factory through the virtual factory. Among them, nearly 75% of production operations have been automated (Figure 8-5). Products can communicate with the production equipment, and the IT system control and optimization of all processes to ensure that 99.9988% of the product qualified rate.

In 2013, the Siemens Electronic Works Chengdu (SEWC), a sister factory of the Amberg plant, was put into production in Chengdu (Figure 8-6), Sichuan province. SEWC is Siemens’ first digital factory in China. SEWC is responsible for the development and production of Siemens’ global industrial automation products. The products mainly include programmable logic controllers (PLC), the human-machine interfaces (HMI), industrial computers (IPC) and

so on. The whole digitalization processes from management, R&D, production to logistics distribution are realized by Siemens digital software suite and other products and applications such as Simatic. The data interconnection with German production base and the R&D center of the United States is realized by the information network.



Figure 8-5 Today's most modernized production facilities



Figure 8-6 The Siemens Electronic Works Chengdu

In the picture of smart factory, real and virtual production environments will be integrated. Products can communicate with each other and with production systems in order to optimize the production process. By that time, the factory will be largely self-controlled and optimized.

8.3A



Made in China 2025

In 2015, China officially issued “Made in China 2025”. It put forward the strategic goal of realizing the manufacturing power by “three steps”. First, China will step into the ranks of manufacturing power by 2025. Second, China’s manufacturing industry as a whole will reach the medium level of the world’s manufacturing power camp by 2035. Third, China’s comprehensive strength will rank among the leading manufacturing powers in the world by the 100th Anniversary of New China (Figure 8-7).



Figure 8-7 Chinese high speed rail

The plan of “Made in China 2025” gives priority to the development of ten fields: the new generation of information technology industry, high-grade Computer Numerical Control(CNC) machine and robots, aerospace equipment, marine engineering equipment and high-tech ships, advanced rail transit equipment, energy-saving and new energy vehicles, power equipment, agricultural machinery equipment, new materials, biomedicine and high-

performance medical devices. At the same time, five major projects will be constructed: the construction project of manufacturing innovation center, strengthening infrastructure project, intelligent manufacturing project, green manufacturing project and high-end equipment innovation project.

The manufacturing industry is the main body of the national economy, the foundation of the establishment of the country, the weapon of rejuvenating the country and the foundation of the powerful country. The fundamental goal of “Made in China 2025” is to change China’s manufacturing sector and comprehensively improve the quality and level of China’s manufacturing industry.

New Words

comprehensive [ˌkɒmprɪ'hensɪv] adj. 综合的；广泛的；有理解力的

comprehensively [ˌkɒmprɪ'hensɪvli] adv. 包括地

anniversary [ˌænɪ'vɜːsəri] n. 周年纪念日

adj. 周年的；周年纪念的

priority [praɪ'ɒrəti] n. 优先，优先权

aerospace ['eərəʊspeɪs] n. 航空与航天空间；宇宙空间

vehicle ['viːɪkl] n. 车辆；运载工具；传播媒介；交通工具

biomedicine [ˌbaɪəʊ'medɪsn] n. 生物医学

construct [kən'strʌkt] vt. 构成；修建，建造

innovation [ˌɪnə'veɪʃn] n. 改革，创新

strengthen ['streŋθn] vt. 加强，巩固

infrastructure ['ɪnfə'strʌktʃə(r)] n. 基础设施；基础建设

foundation [faʊn'deɪʃn] n. 基础；地基；粉底；基金（会）

establishment [ɪ'stæblɪʃmənt] n. 建立；企业

rejuvenate [rɪ'dʒuːvəneɪt] vt. 使变得年轻，使恢复活力

vi. 复原，变年轻

sector ['sektə(r)] n. 部门; 领域; 扇形

Phrases and Expressions

put forward: 提出

computer numerical control: 计算机数(字)控(制)

agricultural machinery: 农业机械; 农机

Notes

(1) The plan of “Made in China 2025” gives priority to the development of ten fields: the new generation of information technology industry, high-grade Computer Numerical Control(CNC) machine and robots, aerospace equipment, marine engineering equipment and high-tech ships, advanced rail transit equipment, energy-saving and new energy vehicles, power equipment, agricultural machinery equipment, new materials, biomedicine and high-performance medical devices.

aerospace equipment → 航空航天装备; marine engineering equipment → 海洋工程装备; biomedicine and high-performance medical devices → 生物医药及高性能医疗器械。

(2) Manufacturing industry is the main body of the national economy, the foundation of the establishment of the country, the weapon of rejuvenating the country and the foundation of the powerful country.

the foundation of the establishment of the country → 立国之本; the weapon of rejuvenating the country → 兴国之器; the foundation of the powerful country → 强国之基。

8.3B

3D Printing



3D printing technology, which appeared in the 1990s, is a kind of cumulative manufacturing technology, that is, rapid prototyping technology. The principle of 3D printer (Figure 8-8) is to “print” real 3D objects layer by layer in accordance with the procedure based on digital model files, with special waxes, powdery metals or plastics and other adhesive materials, and eventually turns the computer blue print into real objects.



Figure 8-8 3D printer

The biggest difference between a 3D printer and a traditional printer is that the “ink” the 3D printer uses is a real raw material, which has various stacking forms of thin layers and can be used in a wide variety of media, ranging from plastic to metal, ceramics and rubber and so on.

The designing process of 3D printing is: first modeling by computer software, then “partitioning” the built 3D model into sections layer by layer, that is, slicing, thus instructing the printer to print layer by layer.

A 3D printer is a magical machine that can print almost everything (Figure 8-9): houses, organs, cars, clothes, jewelry, robots...it can be used in industrial design, architecture, medical care, education, geographic information systems, aerospace and many other fields.

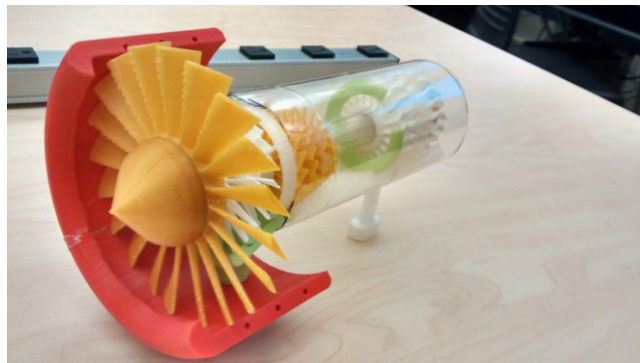


Figure 8-9 A 3D-printed jet turbine

In November 2010, the U.S. Jim Kor team built the world’s first 3D-printed car Urbee (Figure 8-10).

In November 2012, Scottish scientists used human cells to print out an artificial liver tissue by a 3D printer for the first time.

In September 2014, NASA completed its first imaging telescope, and all components were basically manufactured by 3D printing technology (almost all the components were manufactured through 3D printing technology). The space telescope is fully functional, with

its outer tubes, external baffles and optical frames all printed directly as separate structures.



Figure 8-10 The 3D-printed car “Urbee”

On April 22nd, 2015, Zhujiang Hospital of Southern Medical University completed the operation of complex liver tumor resection with 3D printing technology instruction. Professor Fang Chi-hua, the surgeon in charge of the operation, said the operation was complex and difficult, and could not be done without the help of a 3D printed liver model.

On July 17th, 2015, a new 3D printed module villa appeared in Xi'an, where the builders completed the building in three hours. According to the builder, the three-hour hardcover villa can be checked in as long as it is furnished.

On April 21st, 2016, China's first space on-orbit 3D printer debuted in Chongqing. The manufacturing of space on-orbit 3D printing solved the maintenance support problem of space station, which is a necessary guarantee to complete the deep space exploration mission in the future. It is understood that compared with the normal 3D printer which can only work under the condition of normal gravity, the space on-orbit 3D printer can work under the condition of overweight, weightlessness and normal gravity (Figure 8-11).

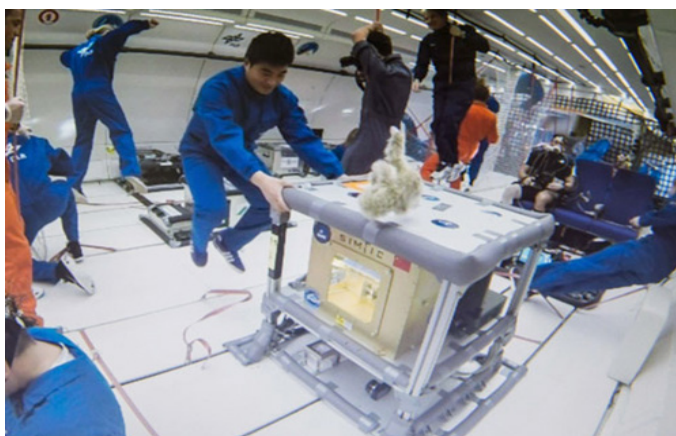


Figure 8-11 Flight test of 3D printer

3D printing doesn't have to be machined or molded. It no longer breaks things down into different parts, and then produces them separately and assembles them. 3D printing creates an actual object directly from computer graphics data, which greatly shortens the production cycle and improves productivity. 3D printing technology is bound to become one of the many technological breakthrough in the future manufacturing industry.

8.4A

BigDog



BigDog is a quadruped robot designed by Boston Dynamics, in the hope that it can carry equipment along with the soldiers on the march as a robotic mule (Figure 8-12, 8-13).



Figure 8-12 BigDog

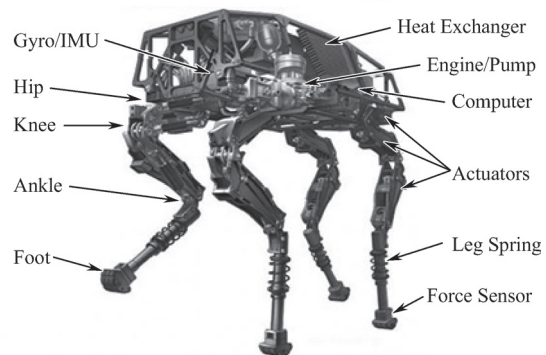


Figure 8-13 BigDog's architecture

BigDog's legs contain a variety of sensors. Its four legs can move freely like the "pedestrian" chariot used by the imperial army in the "Star Wars". The walking pattern of BigDog is controlled by four legs with actuators. It also uses a laser gyroscope and a stereo

vision system. Its locomotion is controlled by an on-board computer that receives input signals from various sensors of the robot.

BigDog can stand up and sit down. It lifts one leg at a time when walking with a crawling gait. It walks up and down with a trotting gait lifting diagonal legs, or trots with a running gait (Figure 8-14). It runs at 7 km/h, and climbs slopes can be up to 35 degrees. It can walk across gravel roads, climb muddy trails, walk in snow and water, and carry up to 150kg loads (Figure 8-15).



Figure 8-14 BigDog Is Trotting



Figure 8-15 Products of Boston Dynamics

The project of BigDog was discontinued in 2015 due to the engine was too noisy. In 2016, Boston Dynamics showed a robot that walked more freely——SpotMini. SpotMini can realize the function of navigation and moving objects and so on, which looks more like a robot pet.

New Words

- quadruped** ['kwɒdrʊpɪd] n. 四足动物
adj. 四足的
- mule** [mju:l] n. 骡子, 顽固的人, 杂交种动物
- terrain** [tə'reɪn] n. 地形, 地势
- imperial** [ɪm'piəriəl] adj. 帝国的, 皇家的
n. 特级品
- pedestrian** [pə'destrɪən] n. 行人, 步行者
adj. 徒步的
- locomotion** [ləʊkə'məʊʃn] n. 运动, 移动, 运动力
- gait** [geɪt] n. 步态, (走, 跑等的) 速度
v. 训练 (马的) 步法
- diagonal** [daɪ'æɡənəl] n. 斜线
adj. 对角线的, 斜的
- hiking** ['haɪkɪŋ] n. 徒步旅行
v. 徒步旅行
- deem** [di:m] v. 认为, 主张, 断定
- nimble** ['nɪmbl] adj. 灵活的, 敏捷的

Phrases and Expressions

- Boston Dynamics:** (美) 波士顿动力公司
- Defense Advanced Research Projects Agency:** 美国国防部高级研究计划署
- pack mule:** 驮骡
- Star Wars:** 《星球大战》
- stereo vision system:** 立体视觉系统
- petrol-powered engine:** 汽油发动机

all-electric robot: 全电动机器人

Notes

(1) BigDog is a quadruped robot designed by Boston Dynamics, in the hope that it can carry equipment along with the soldiers on the march as a robotic mule.

designed by Boston Dynamics → designed 为过去分词，作为定语 → designed by 译为“由……设计” → 由波士顿动力公司设计的。

in the hope that it can carry equipment along with the soldiers on the march as a robotic mule → 此处 that 引导一个目的状语从句 → 希望它能作为一个机器骡子随同士兵在行军中运载装备。

(2) Its locomotion is controlled by an on-board computer that receives input signals from various sensors of the robot.

by an on-board computer → 通过一个机载计算机

an on-board computer that receives input signals from various sensors of the robot → that 引导一个定语从句，修饰 an on-board computer → 从机器人的各种传感器中接收输入信号的机载计算机。

(3) SpotMini can realize the function of navigation and moving objects and so on, which looks more like a robot pet.

which looks more like a robot pet → which 引导的非限定性定语从句 → which 指代前面整个句子的意思 → 看起来更像一个机器人宠物了。

8.4B



The Development of Chinese Quadruped Robots

Boston Dynamics, one of the most influential robotic companies in the world, has developed BigDog, SpotMini and other quadruped robots in the past 25 years. Meanwhile, how about the progress of Chinese quadruped robots ?

2011:Chinese Quadruped Robot Took Its First Step

FROG, a quadruped robot, was invented by Dr.Wang Wei's team of Institute of Automation, the Chinese Academy of Science. It was also a research platform used to develop

and test quadruped gait control, gait transition and other locomotion algorithms. Dr.Wang hoped it would be a prototype for the endoskeleton of a robotic triceratops.

FROG uses the Linux system to interact with its computer in a wireless way, but it still needs a power plug when it is used. The body joints have an acceleration sensor that can simulate walking and so on. Unlike hydraulic BigDog of Boston Dynamics, FROG uses DC motors for moving (Figure 8-16).



Figure 8-16 FROG quadruped robot

2016: “Running” Won the Championship

On September 6th, 2016, a Chinese domestic robot named “Running” (Figure 8-17), which was from the mountain quadruped bionic mobile platform, participated in the “Across the Obstacles 2016” ground unmanned system challenge. The robot won the 50 meter speed



Figure 8-17 “Running”

and the comprehensive cross-country laurel. The result was exciting. The comprehensive strength of China's unmanned platform has been on par with the most advanced international level. In some indexes it has beyond BigDog of Boston Dynamics.

“Running” is powered by gasoline. It has a long range and is easy to add fuel. Its speed is between 5 and 11 km/h, even faster than the pace of human walking. It can maintain its own balance, and it has the ability to correct itself when it is out of balance and even regain its footing. Compared to the driverless vehicle, it has the biggest advantage that it can surpass the impassable obstacles for vehicles. “Running” can be used as a general platform and be applied to the material handling of complex rugged pavement.

2017: China's Robot Rival the Finest American Product

In October 2017, Unitree Robotics, a company founded by Chinese roboticist Wang Xingxing, released a quadruped robot called Laikago (the name comes from space dog Laika), the performance of which is close to BigDog of Boston Dynamics.

Laikago weighs only 22kg but has a strong power system with 12 high-performance motors and 18 kW of instantaneous power. Meanwhile, Laikago has been completely free of external power supply.

Unitree Robotics also imitated a test video of Boston Dynamics. In the video Laikago climbed up the slope, crossed the flagstone road, and reproduced the scene of the classic testers kicking (Figure 8-18). The testing result was that Laikago was excellent in stability like BigDog. However, at present, Laikago doesn't yet have the vision system to perform tasks autonomously.



Figure 8-18 A test of Laikago's stability by kicking

Laikago is a platform for scientists to study robots. With further improvements, the robot could also be used in applications like package delivery.

2018: Zhejiang University Released a Quadruped Robot

At the beginning of 2018, a robot research team leader Professor Xiong Rong of Zhejiang University released a quadruped robot called “JueYing” (Figure 8-19). The robot is 1 meter in length and 60 centimeters tall when standing and weighs 70 kilograms. Its load can reach 20 kg, its walking speed is 6 km/h, and its endurance time is 2 hours.



Figure 8-19 The “JueYing” robot

The robot has mastered many skills such as running and jumping, climbing the ladder, walking in the gravel road, squatting down and standing up by itself. These skills are expected to be used in security, investigation, disaster relief and other practical scenes.

In recent years, China has been trying to catch up in the field of legged robots, such as Ironman Technology, which launched the bipedal humanoid robot in 2017, and Shanghai Jiao Tong University has showed their hexapod robot. It is understood that Shandong University, Harbin Institute of Technology, the military and other institutions are also conducting the research at present. It is believed that in the near future, Chinese quadruped robots will catch up with the world’s advanced level and even take its place in the front ranks of the world.

Unit 9

Artificial Intelligence

9.1



The Main Influences of Artificial Intelligence on Society

Artificial intelligence is a new science and technology to study and develop theoretical methods and technical means to simulate and expand human intelligence. It has a very wide application prospect. Artificial intelligence will subversively change the future life of human beings like other important scientific and technological changes in human history.

When the CEO of Google talked about the impacts of artificial intelligence on society, he indicated that artificial intelligence is the most important thing that human beings are studying at present, which is even more profound than “the significance of electricity or fire.” But he pointed out that people’s worries about artificial intelligence are also justifiable.

What are the main influences of artificial intelligence on human society?

1.The employment problem

The rise of artificial intelligence will lead to the occurrence of “unemployment tide”, which has become the consensus of any industry. Moses Wadi, a computer engineering professor at Rice University, recently said that in the next 30 years, artificial intelligence can do all the work of human beings. He estimated that the rate of human unemployment in 2045 will exceed 50%. Cashiers in the future will be reduced by the popularity of smart cashier technology, shop assistants will be less after the use of smart cameras, and ordering staff will also become less due to the use of automatic ordering system. Smart banks, smart stores, driverless cars, and driverless aircraft will increasingly change people’s life (Figure 9-1).

2.Changes in social structure

On one hand, people hope that artificial intelligence and intelligent machines can replace human work in all kinds of labor. On the other hand, they are worried that the development

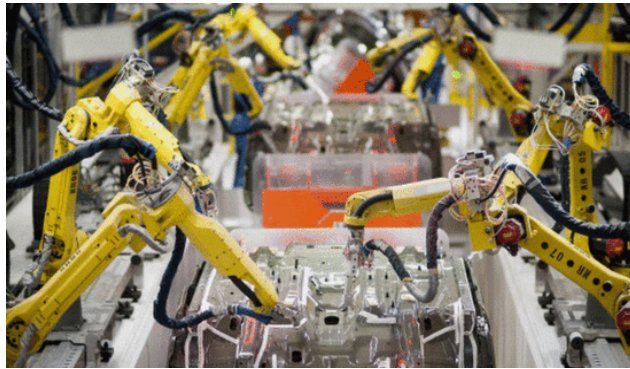


Figure 9-1 Human work is replaced by robots

will cause new social problems. In the last decade or so, a quiet change has taken place in social structure. The social structure of “human-machine” will eventually be replaced by that of “human-intelligent machine-machine”. Many of the jobs that are now and in the future taken by humans are supposed to be undertaken by robots, so people will have to learn to get along with intelligent machines and adapt to the changing social structure.

The “tool AI” everywhere in life has been affecting our lives all the time. So we can pay more attention to “creative work of perceptual abstraction” from “dull work of repetitive labor”.

3.Changes of thinking mode and concept

The mastery of knowledge in artificial intelligence will be dynamic, constantly increasing and updated. AI is becoming more and more advanced, the Internet industry is becoming more and more developed, and our dependence on artificial intelligence is becoming stronger and stronger. In the end, perhaps people will just listen to the advice given by computers, and their cognitive ability will become weaker and weaker. And losing the sense of responsibility to learn about problems in daily life may be the real threat of AI.

4.Danger of technology out of control

It is the greatest danger of any new technology that mankind has lost control of it or that it has fallen into the hands of those who attempt to use new technology against humanity. Just like nuclear weapons, humans have invented nuclear weapons, but increasingly they are realizing it impossible to control the horrific impact the nuclear weapons will bring. Some people are concerned about the threat of robots and other products of artificial intelligence to human security. Therefore, the famous American science fiction writer Asimov put forward “The Three Principles of Robotics”:

One, a robot may not injure a human beings, or, through inaction, allow a human being to

come to harm.

Two, a robot must obey the orders given by human beings except which violates the Principle One.

Three, a robot must protect its own existence as long as such protection does not conflict with the Principle One or Principle Two.

The influence of artificial intelligence on society will permeate into every corner. The development of AI is the inevitable trend of the development of human science and technology. In the face of this trend, we should maintain a positive and optimistic attitude, keep developing, and always be innovative. Only in this way can AI promote the progress and development of society.

9.2A



Smart Home

Smart home (Figure 9-2) takes the house as the platform, uses the integrated wiring technology, the network communication technology, the automatic control technology, and the audio and video technology to integrate the home life related facilities, constructs efficient residential facilities and family schedule management system, and promotes home security, convenience, comfort, and artistry. It realizes the living environment of environmental protection and energy saving.

Smart home makes you enjoy life easily. When you go out, you can use your mobile phone and computer to control the smart home system: open your air conditioner and water heater in advance on the way home. When you get home, the system will automatically open

the aisle lights, the electronic lock, the home lighting and window curtains to meet your return.



Figure 9-2 Smart home

When you are at home, you can sit on the sofa with a remote-controller to control everything in the house, select the presupposed lighting scene by the intelligent lighting system, create a comfortable silence in study when reading, create a romantic light atmosphere in the bedroom, and adjust the state of the curtain and acoustics. The kitchen is equipped with a video phone, so you can cook while you are on the phone or are checking the visitors at the door.

When you are at work in the company, the home situation can also be displayed on your office computer or cell phone for you to check at any time.

Smart home integrates individual needs and realizes a new “people-oriented” life experience (Figure 9-3).



Figure 9-3 “People-oriented” life experience

New Words

smart [smɑ:t] adj. 聪明的；敏捷的；漂亮的；整齐的；智慧的

vi. 疼痛

video ['vɪdiəʊ] n. 视频；录像磁带；录像机

adj. 视频的；电视的

environment [ɪn'vaɪrənmənt] n. 环境，外界；周围，围绕

automatically [ɔ:tə'mætɪklɪ] adv. 自动地；无意识地；不自觉地；机械地

aisle [aɪl] n. 过道，通道；侧廊，耳堂；狭长的通路

adjust [ə'dʒʌst] vt.& vi. 调整，校正；调对准，校正

state [steɪt] n. 国家；州；状况，情况；资格

vt. 规定；声明；

adj. 国家的；公务的；正式的

curtain ['kɜ:tɪn] n. 窗帘，门帘；启幕，落幕

vt. 掩蔽

cell [sel] n. 电池；[生] 细胞；小；[诗] 墓穴

integrate ['Intɪɡreɪt] vt. 集成

vi. 合并

adj. 整体的；完整的；完全的

oriented ['ɔ:riəntɪd] adj. 导向的；定向的

Phrases and Expressions

smart home: 智能家居

integrated wiring technology: 综合布线技术

efficient residential facilities: 高效住宅设施

in advance: 提前

on the way home: 在回家的路上

presupposed lighting scene: 预设的灯光场景

intelligent lighting system: 智能化照明系统

people-oriented: 以人为本

Notes

(1) uses the integrated wiring technology, the network communication technology, the automatic control technology, and the audio and video technology to integrate the home life related facilities

这部分句子中有几个并列成分：the integrated wiring technology, the network communication technology, the automatic control technology, the audio and video technology, 这些成分全部作为 uses 的宾语，to integrate the home life related facilities → 不定式作为目的状语 → use...technology to do sth. → 使用……技术去做（某事）。

在 constructs efficient residential facilities and family schedule management system 中，and 连接两个宾语：efficient residential facilities 和 family schedule management system → and 后面省略了谓语 constructs → 构建高效的住宅设施与家庭日程事务的管理系统。

(2) the system will automatically open the aisle lights, the electronic lock, the home lighting and window curtains to meet your return: to meet your return → 不定式作为目的状语 → 整个句子结构是 the system+ open...+ to meet your return → 系统会自动打开过道灯，同时打开电子门锁；开启家中的照明灯具和窗帘迎接您的归来。

9.2B



Bill Gates' Smart Home

Bill Gates' smart home is called "Xanadu2.0", located beside the Washington Lake in Seattle, USA. The mansion covers an area of 5 acres and is built according to the topography, surrounded by a large number of alders, maples and Douglas firs and other plants in the United States. The building is integrated with the surrounding natural environment (Figure 9-4).



Figure 9-4 The view of Bill Gates' smart home

1. The digital complex of "the world's richest man"

The whole building has been covered by optical fiber cables with the length of eighty-four kilometers, but no sockets or cables can be seen on the wall. The power supply cables and digital signal transmission optical fiber are hidden underground. The power supply system and the optic digital neural network system will send the host's needs to the computer and household appliances perfectly, so that the computer can receive the information of the mobile phone and the sensor, and the systems of bathroom, air conditioning, sound and light can all understand and follow the command of the central computer.

2. The intimate service of "electronic brooch"

Guests will receive electronic brooch at the door. Special guest brooch will set up guest information which will be stored in the computer as visiting data. No matter where the guests

go, the computer system can detect their identity and exact location. Under the control of artificial intelligence, room lights and other devices have automatic adjustment functions; music will follow you, because invisible loudspeakers are installed behind the wallpaper; the brooch can preset your favorite temperature, humidity, light, music, painting, and other conditions; the built-in sensors will send the data to the central computer and adjust your environment to being at home.

The sensors under the floor can track people's footprints within the range of 15cm, automatically turn on the system when people come, and automatically turn off the system when people leave.

3. Smart science and technology ensure safety

Science and technology endow the smart home with a strict security barrier. There is an advanced access control system installed at the entrance. When other people enter through the system, it will notify the host, and the host will then give the computer commands to open the door and send the brooch. Then guests are allowed to enter. If a guest does not have a brooch, he will be identified as an intruder by the system, and the computer will automatically give an alarm through the network.

When one security system fails, another set of standby system will start automatically. If the host presses the “rest” button, the intelligent alarm system around the house starts to work. Those cameras hidden in the dark can make shoot without dead-zones. Fire also needn't to be worried about, because the residential fire system will automatically give an alarm through the communication system, show the best rescue plan, cut off the dangerous power system, and allot water supply according to the intensity of fire.

4. Stunning intelligent devices

The application of high technology in smart home is surely amazing. The door is equipped with a weather sensor, from which the indoor temperature and ventilation are controlled according to various weather indicators. The kitchen is equipped with automatic cooking equipment, and the commercial kitchen can provide catering services for more than 100 people. Of course, there is a special restaurant that can hold 24 people to enjoy the fireplace dinner. Even a computer system for checking the body is installed in the toilet. If it detects anything abnormal with your body, the computer will automatically send out a warning. In the garden, through advanced sensor equipment, 24 hours of monitoring can be done to achieve targeted automatic watering and fertilization according to the growth of plants.

The conference room in “Bill Gates' Smart Home” has a 24-hour access to the Internet to

video conference at any time, and the computer can also use the sensors throughout the room to automatically record what is happening inside the house.

5. Bill Gates' favorite super private library

The private library in Gates' mansion covers an area of 2100 square feet. In the luxuriously designed library which is also equipped with advanced control equipment, there is a domed reading room with a skylight receiving natural light in the middle of the roof. The indoor light is adjusted with the changes of light outside (Figure 9-5).

Just on the ceiling of Bill Gates' private library, there is a sentence from *《The Great Gatsby》* :

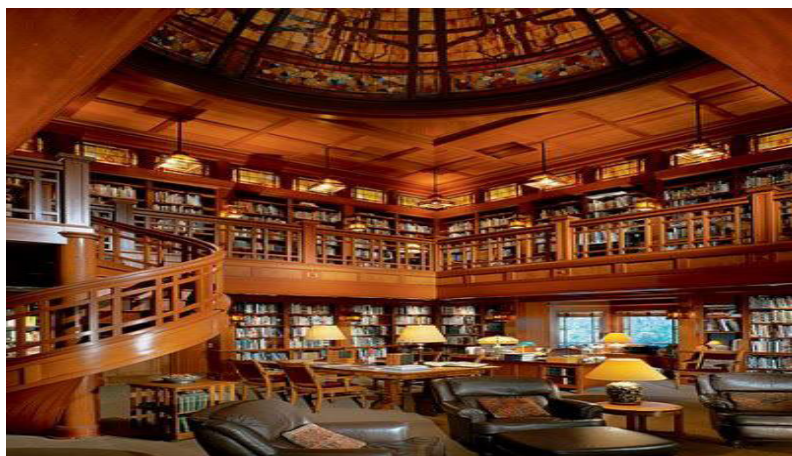


Figure 9-5 Bill Gates' Private library in his mansion

He had come a long way to this blue lawn, and his dream must have seemed so close that he could hardly fail to grasp it.

Bill Gates' smart home took seven years to build, and can be regarded as the classic works of smart home today. It is not only magnificent, but also full of wisdom, so it is also called the "house of the future".

9.3A

Driverless Cars



Driverless technology is an integrated technology involving sensors, computers,

information and communication, automatic control, navigation and positioning, machine vision, artificial intelligence and many other leading disciplines. It is an important indicator of a country's industrial level.

Here are two important structures on driverless cars:

First, the laser sensor, as shown in Figure 9-6, it quickly draws the surrounding topographic map, finds obstacles and calculates its trajectory.

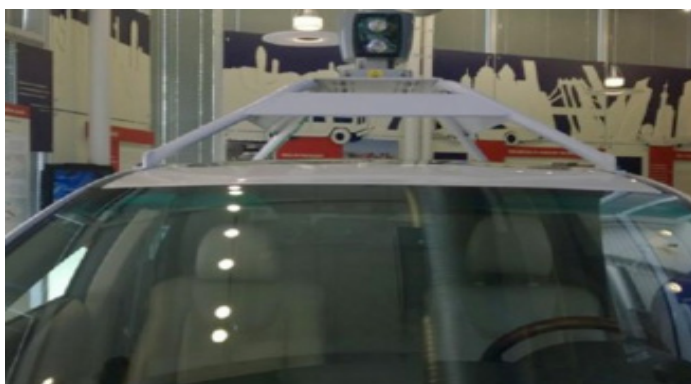


Figure 9-6 The laser sensor

Second, the intelligent pilot, equivalent to the “central control” computer of the driverless car, it can automatically plan the route, control the steering and speed of the vehicle, so that the vehicle can safely and reliably drive on the road. Figure 9-7 is the “field of view” in the eyes of the smart pilot, with pink indicating a safe object that does not conflict with the driving route and green indicating obstacles that block the driving route. (编者注：本图仅展示图像，不显示彩色效果)

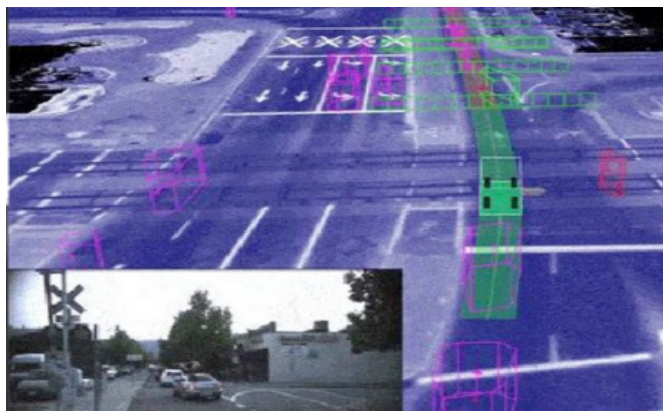


Figure 9-7 The “field of view” in the eyes of the smart pilot

In 2005, China’s first urban driverless car was successfully developed at Shanghai Jiao Tong University. In February 2018, an unmanned Porsche Panamera controlled by a Huawei Mate 10 Pro smartphone debuted at the World Mobile Communications Conference (MWC) trade show in Barcelona.

It is believed that one day the technology will be fully matured. Each of us will have a “special car driver” who will serve itself 24 hours a day. Car accidents that endanger life and safety will forever stay away from us (Figure 9-8)!



Figure 9-8 Driverless cars

New Words

- driverless** [d'raɪvərləs] adj. 无人驾驶的
vehicle ['vi:ɪkl] n. 交通工具, 车辆, 手段, 工具
automatically [ɔ:tə'mætɪkli] adv. 自动地, 无意识地, 机械地
indicator ['ɪndɪkeɪtə] n. 指示器, 指示剂, 指标
industrial [ɪn'dʌstriəl] adj. 工业的, 产业的
laser ['leɪzə] n. 激光器
topographic [ˌtɒpə'græfɪk] adj. 地形的, 地形学的
trajectory [trə'dʒektri] n. 轨道, 弹道, 轨线
endanger [ɪn'deɪndʒə] vt. 使遭危险, 危及, 危害
discipline ['dɪsɪplɪn] n. 纪律, 训练, 学科, 科目

Phrases and Expressions

- conflict with:** 与……冲突, 与……相抵触, 与……矛盾
stay away: 离开, 不接近, 保持距离
so that: 以便, 以使, 以致
on the road: 在途中, 居无定所, 漂泊
one day: (总)有一天, 一天, 一日

Notes

(1) country's 为名词所有格。在单数情况下把 's 直接加上去, 如: Jack's new car (杰克的新车)。若名词已有复数词尾, 则仅加 ', 如: the workers' reading-room (工人阅览室)。如果名词是复数却不以 -(e)s 结尾, 仍应加 's, 如: The men's room (男厕所)。以 -s 结尾的单数名词后, 可加 's, 也可加 ', 但均读为 /ɪz/, 如: Paris's / Paris' hotel (巴黎的酒店)。以 -ts 结尾的名词只加 ', 读为 /ts/, 如 Keats' poems (济慈的诗)。

(2) Figure 9-7 is the “field of view” in the eyes of the smart pilot, with pink indicating a safe object that does not conflict with the driving route and green indicating obstacles that block the driving route.

第 1 个 indicating 为现在分词, 参与构成 “with + n. + 现在分词” 复合宾语结构。复合宾语是指宾语由两部分组成, 后面部分也可称为宾语的补语。

9.3B



AlphaGo

On March 5th, 2016, AI AlphaGo defeated the world Go champion, Li Shishi, which caused worldwide panic about artificial intelligence. In fact, on May 11th, 1997, when the computer Deep Blue defeated the world chess champion Kasparov, the world was even more frightened. But many experts believe that Deep Blue is nothing more than that, and that the appearance of AlphaGo is an epoch-making event. Why is that? This is not because Go is much more complicated than chess, but because AlphaGo and Deep Blue are quite different in algorithm.

There are two core principles of Deep Blue. One is that it records a large number of master's chess scores, which are checked and used in the same situation, and the other is to use a fixed formula to calculate the score of optional move according to the position and quantity of the pieces and the chess manual which is the most same as playing. Pick the next step according to the situation with the highest score, so every step of Deep Blue is told. The core principle of AlphaGo is "deep learning". Deep learning simulates the working principle of biological brain neural network. Its mathematical description is complicated, but it can be summed up simply that every step of AlphaGo is "learned" by itself.

Deep Blue's behind-the-scenes team includes several chess masters, and everything from computer hardware to software is tailored for chess, even tailored for Kasparov. One of the best players of AlphaGo's behind-the-scenes team, is just an amateur. AlphaGo can play against any player on any general-purpose computer. Deep Blue defeated Kasparov with a weak advantage of 3.5-2.5, while AlphaGo defeated Li Shishi (Figure 9-9) by an absolute advantage of 4-1. In May 2017, it fought again against one of the world's best chess player, Ke Jie (Figure 9-10), with the score 3-0. China's world champion Ke Jie had no chance to win.

In fact, the so-called "intelligence" is not "a unique gift of God to mankind". It is just an ability of animals to abstract, try, and choose from complex natural environments. The earliest purpose is only to adapt to the environment and survive. Because one person's energy is limited, so his "intelligence" in a particular field may not be "perfect" even by lifelong accumulation. But "deep learning" computer can accumulate "intelligence" beyond the human level in a very short period of time through tirelessly high-speed operation. For example, AlphaGo can complete millions of games in one day, which a

person can never achieve in his life.



Figure 9-9 Li Shishi from Korea



Figure 9-10 Ke Jie from China

So what we should seriously understand is not AlphaGo but “deep learning”. Deep learning is not only used to play go, but can also be used in the field of industry, agriculture, medicine, military and so on. AlphaGo symbolizes the computer technology has entered a new era of artificial intelligence in information technology. Its characteristic is the trinity of big data, big calculation and big decision, and its intelligence is approaching or surpassing mankind.

9.4A

Internet of Things



Human’s appetite for control is boundless, so the Internet of Things (Figure 9-11) comes into being. Scientists give all the objects they want to control access to the RFID system, whereupon people can monitor, manage and even interact with the objects through the Internet at anywhere in the world. This is the Internet of Things. Let’s see what the Internet of Things can bring about.



Figure 9-11 Internet of things

HSR system: the Internet of Things can know the location, speed and condition of each passenger compartment at any time, and direct them to anywhere they should go.

Logistics checking: for those who love online shopping, they can go online to check where the package is and when it will be delivered.

ETC system: at the freeway toll gate, drivers no longer need to wait in line to pay their bills. When they get through the gate, the Internet of Things will automatically record the status of their cars and deduct the fees.

Smart agriculture: every plant and fruit can be managed by the Internet of Things system. The products will have the best quality to sell at the best price.

Smart home makes us safer and more comfortable; the 2nd-generation ID cards make the society more orderly; intelligent buses make it more convenient for citizens to go on a ride; water, electricity and gas meter reading system makes residents worrieless; Skynet security

system makes China safer. The Internet of Things is everywhere, leading us to a better intelligent life.

New Words

appetite ['æpɪtaɪt] n. 欲望; 胃口, 食欲; 嗜好, 爱好

boundless ['baʊndləs] adj. 无限的; 无穷的; 无边际的; 广阔的

whereupon [ˌweərə'pɒn] adv. 于是; 因此

conj. 于是

interact [ˌɪntər'ækt] v. 互动; 相互作用; 互相影响

compartment [kəm'pɑ:tmənt] n. 隔间 (尤指火车车厢中的); 区划

vt. 分隔; 划分

logistic [lə'dʒɪstɪkl] adj. 逻辑的

n. 物流; 后勤; 逻辑学; 组织工作

deliver [dɪ'lɪvə(r)] vt. 交付; 发表; 递送; 使分娩

toll [təʊl] n. 通行费; 伤亡人数; 钟声; 长途电话费

v. 鸣钟; 敲钟

deduct [dɪ'dʌkt] vt. 演绎; 扣除, 减去

convenient [kən'vi:niənt] adj. 方便的; [废语] 适当的

Phrases and Expressions

Internet of Things: 物联网

come into being: 诞生

smart home: 智能家居

meter reading system: 抄表系统

Skynet security system: 天网安防系统

Notes

(1) Human's appetite for control is boundless, so the Internet of Things comes into being.

so 表示“因此, 所以”的意思 → so the Internet of Things comes into being → 这里 so 是并列连词, 前后两个句子是并列关系。

(2) the Internet of Things will automatically record the status of their cars and deduct the fees.

and 连接的是 record 和 deduct 两个并列谓语，其主语都是 the Internet of Things → 物联网会自动记录汽车的状态并扣费。

(3) Smart home makes us safer and more comfortable; the 2nd-generation ID cards make the society more orderly; intelligent buses make it more convenient for citizens to go on a ride; water, electricity and gas meter reading system makes residents worriless; Skynet security system makes China safer.

Smart home makes us safer and more comfortable → 主语是 Smart home，谓语是 makes，宾语是 us，safer and more comfortable 是宾语补足语 → 智能家居让我们更舒适安全。

这句话由用分号隔开的 5 个并列句组成，每个句子的结构都是：主语 + 谓语 + 宾语 + 宾语补足语。这种句式的使用构成了排比的修辞手法。

9.4B

RFID



Radio frequency identification (RFID) is a non-contact automatic identification technology. It automatically identifies target objects and obtains relevant data by radio frequency signals, and identifies work without manual intervention, which can work in all kinds of harsh environments. RFID technology recognizes high-speed moving objects and recognizes multiple labels at the same time, which is fast and convenient to operate.

Short distance RF products are not afraid of poor environment such as oil stains and dust pollution. They can replace bar codes in such environment, like tracking objects on the factory's production line. Long distance radio frequency products are mostly used in traffic, and the identification distance can be up to tens of meters, like automatic charging or vehicle identity identification traffic, etc.

The most basic RFID system consists of three parts (Figure 9-12):

Tag: consisting of a coupling element and a chip, each label has a unique electronic code attached to an object to identify the target object.

Reader: a device that reads (sometimes can also be written in) label information, which can be designed as hand-held or fixed.

Antenna: transmitting radio frequency signals between the tag and the reader.

RFID is widely used in every aspect of our life. When we drive a car, ETC is the best

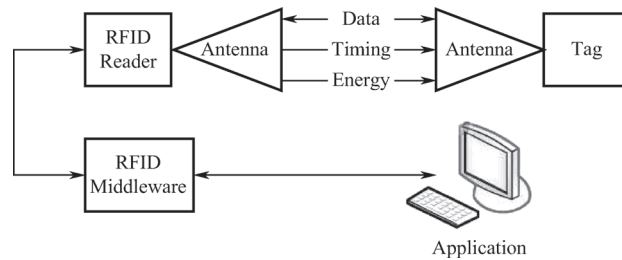


Figure 9-12 The composition and the working principle of RFID

choice if we want to get through the freeway entrance quickly. ETC (Figure 9-13) is the most advanced way of charging on roads and bridges at present. Through the special short range communication between the vehicle mounted electronic label mounted on the windshield and the microwave antenna on the ETC lane of the toll station, the backstage settlement processing is handled by the computer network technology and the bank, so that the vehicle can automatically pay the road and bridge fee through the toll station without parking.



Figure 9-13 The ETC channel for Expressway

The RFID warehouse logistics management system manages the logistics goods in an intelligentized and informationalized way, and realizes the functions of automatically recording the information of goods in and out of the warehouse, the intelligent warehouse inventory, the record and release of the state information of the goods, and the output of the state report of vehicles. Relying on the technological advantages of RFID, the system has the characteristics of realizing long distance recognition, fast speed recognition, and batch identification of asset information. By giving full play to the technical advantages of real-time information acquisition by RFID for each operation link; it can be assured that the enterprises can timely and accurately grasp the state of the inventory. The system can realize the management of warehousing through the collection of materials data by the warehousing

reader. The handheld devices can quickly and accurately check material information and improve inventory efficiency (Figure 9-14).



Figure 9-14 Application of RFID in storage management

RFID technology and its application are in a period of rapid rise. It is recognized by the industry as one of the most potential technologies in this century and its development and application will be a technological revolution of the automatic identification industry.

译文

单元1 互联网时代

1.1 中国移动支付领先全球



现在，很多第一次来中国的外国朋友发现中国的移动支付生活简直太神奇了：从早上出门，到晚上回家，吃饭、乘公交、乘地铁、旅游、购物、住酒店等，可以一次现金都不用使用，全部通过一部智能手机就可以完成预订和付款操作（见图 1-1），实在非常方便和快捷。

对于 2017 年的中国来说，移动支付已经毫无悬念地引领世界，无论是最发达的美国还是日本、欧洲，都没办法像中国这样依靠手机和二维码完成近乎零现金的日常操作。出门不用带钱包而采用移动支付正在成为中国人的生活常态。在街头，老太太卖苹果都用移动支付；在支付宝的“老家”杭州，连路边的乞丐都支持扫码移动支付了（见图 1-2）。



图 1-1 随处可见的移动支付



图 1-2 推荐使用微信支付

2016 年美国移动支付规模为 1120 亿美元。同年，中国为 9 万亿美元，占据全球移动支付半壁江山，遥遥领先全世界其他国家和地区。2017 年，支付宝已经在欧美及东

南亚 33 个国家和地区上线使用。涉及范围包括餐饮、超市、百货、便利店、免税店、主题乐园、海外机场、退税等几乎所有消费场景；而微信支付也已登陆超过 13 个国家和地区，覆盖全球超过 13 万的境外商户，支持 12 种以上的外币结算（见图 1-3）。2018 年 1 月 25 日，以色列成为全球范围内第 38 个支持支付宝扫码付款的国家，再次刷新了纪录。

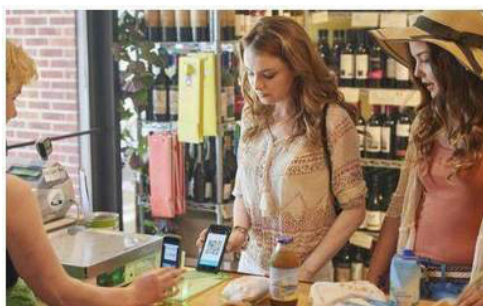


图 1-3 盛行世界的中国移动支付

要知道，在 1987 年之前，中国还没有废除粮票。在短短 30 年后，大多数欧美国家还停留在信用卡时期，中国就直接跨入了移动支付时代（见图 1-4），走在了全世界金融行业最前列。据统计，在 2017 年，中国移动支付交易额达到约 29.5 万亿元，已成为全球最大移动支付市场。而在仅仅数年前，这一数字还接近于零。中国的跨越式发展模式正在成为其他国家借鉴的榜样。



图 1-4 中国人出门可以不带现金

1.2B 中国互联网时代

在美苏争霸年代，出于对核武器的恐惧，美国军方需要设计一种全国性的网络，需求是即使对方摧毁了网络的一部分，剩余的部分依然可以正常指挥核反击，在 1969 年互联网的前身阿帕网（ARPANET）诞生了，信息化在美国率先起步。

我国的信息化进程落后在起跑线上，幸好这是我国少数几个落后得不太多的领域之一。1994 年 4 月 20 日，中国通过一条（带宽为）64KB/s 的国际专线，全功能接入



国际互联网，中国互联网时代从此开启。

1996 年第一家互联网企业“瀛海威”诞生。1997 年 6 月，丁磊创立网易；1998 年张朝阳创立搜狐；1998 年 12 月，王志东创立新浪，这三大门户网站也成为了中国互联网的第一批拓荒者。

1997 年丁磊成立网易时，公司的全部硬件资产只有自己 DIY 的计算机——奔腾 PRO，全部软件产品只有网易 BBS。接着他发现只用 BBS 太浪费资源了，于是在网上四处寻找好看的个人主页并苦求主人把“家”迁移到网易来，由此形成了网易的第二个产品免费个人主页。第三个产品免费邮箱更是获得了巨大成功……火箭般崛起的网易于 2000 年在纳斯达克上市。

1998 年 11 月，腾讯公司成立，1999 年聊天软件 QQ 出现，当时叫 OICQ。1999 年 9 月 9 日马云在杭州正式成立了阿里巴巴集团。2000 年 1 月 1 日李彦宏创建了百度公司。受益于中国网民的数量暴发式地增长，中国互联网飞速赶上了国外的步伐。

2012 年的“双十一”活动中阿里天猫与淘宝的总销售额达到 191 亿元。2017 年，天猫“双十一”成交额为 1682 亿元……随之崛起的还有各种社交网站、团购网站、网络直播、打车软件、今日头条……

根据中国互联网络信息中心（CNNIC）在京发布的第四十一次《中国互联网络发展状况统计报告》，截至 2017 年 12 月，我国网民规模达 7.72 亿，普及率达到 55.8%，超过全球平均水平 4.1 个百分点。其中，手机网民有 7.53 亿。我国移动应用程序总量已超过 1000 万款，中国全面进入移动互联网时代。

2018 年 4 月 23 日，在首届数字中国建设峰会上，美团点评集团首席执行官王兴表示：“互联网在中国发展 20 年后已经跨入数字经济的新阶段”。

中国互联网的春天终于来了，在不少领域我们是当之无愧的互联网领袖！

我们生活在中国互联网的春天。随着移动化、智能化、大数据、云计算、等科技手段的发展，机遇的花朵前所未有的丰富，请你踏着前辈们的脚步，放飞自己的头脑，张开自己勤奋的双手采摘吧！

1.3B 互联网时代引发的个人隐忧



在互联网时代，互联网改变了人们的生活方式与工作方式。它给我们的生活与工作带来极大便利的同时，也带来了一些隐忧。网络是一把双刃剑，只有去弊兴利才能充分发挥其对人类文明的积极作用。

隐私篇

2018 年 4 月，据 BBC（发布的）消息，美国社交网站 Facebook 约有 8700 万用户信息被泄露。

互联网时代，隐私已远离我们而去。电话号码、住址、银行卡号……这些留在支

付宝等平台上的网络痕迹，早已把我们每个人的互联网肖像完全勾勒出来并永久地将其留在网上。电商知道你的消费习惯，专车（软件）清楚你的行踪，移动支付（软件）掌握你的财产变动情况。伴随着这些 O2O 应用及大数据等新技术的爆发式发展，平台运营商可以随时随地在用户不知情的情况下搜集、抓取、分析他们的日常行为信息。我们已成为这个时代的“透明人”，面临着因隐私泄露而导致的金融诈骗、网络暴力、名誉受损等风险。

“人肉搜索”在互联网时代早已屡见不鲜，一句玩笑，一段视频，不经意间就会造成一场不见硝烟的“网络暴力”。2013 年，一名美国女公关职员 Justin Sacco 在去往非洲的飞机上发布了一条开玩笑的 Twitter 状态，在 11 小时内引发了美国人的“全民围剿”，使 Justin 丢掉工作，精神崩溃。

感情篇

互联网使人们错误地感到自己比以往任何时候都更加社会化，但科学研究发现，过度依赖互联网的人情商会降低。在 2015 年的一项研究中，科学家调查了中国年轻一代使用互联网程度与共情水平间的关系。他们发现，大学生中病理性使用互联网（PIU）越多的人，共情能力越低。同时研究也发现，美国大学生的共情水平自 2000 年以来下降了 40%。科学家们普遍认为面对面的交流更易增进人与人的感情，而互联网的存在削减了这种面对面的社交时间，人们花更多的时间独处（见图 1-10）。



图 1-10 智能手机社交模式更受欢迎

工作篇

随互联网而出现的信息化和人工智能，将使许多工作岗位离我们而去，比如：语言翻译，目前的人工智能正在超越人类；工业机器人在很多岗位上已经超越人类；作为司机，无人驾驶汽车马上就会普及；作为出纳和收银员，无人银行和无人超市已经出现。只要是简单的体力劳动和重复性劳动，有谁会比机器人更不怕枯燥不怕累呢？

曙光篇

尽管互联网给我们带来了巨大的冲击，但它也在不断突破我们的认知，让我们的生活更加精彩。也许我们失去了隐私，但收获了便利。也许我们会失去一份简单重复的工作，但能通过努力找到更适应时代需求的工作岗位。

正所谓“水能载舟，也能覆舟”，对待互联网，我们要有正确的态度。既要利用它的“利”来丰富我们的生活内容和提高我们的工作效率，也要看到它的“弊”，防微杜渐。

我们既要保障网络安全，维护网络空间主权和国家安全、社会公共利益，又要保护公民、法人和合法组织的合法权益，促进经济社会信息化健康发展。办法总比困难多！

《中华人民共和国网络安全法》已于 2017 年 6 月 1 日起正式施行。

1.4 数字地球



数字地球就是利用数字技术和方法将地球及其上的活动和环境的时空变化数据，按坐标加以整理，存入全球分布的计算机中，构成一个全球的数字模型，在高速网络上进行快速传播，让人们快速、直观、完整地了解我们所在的这颗星球。数字地球将最大限度地为人类的可持续发展、社会进步以及国民经济建设提供高质量的服务。

地壳运动、地质现象、地震预报、气象预报、土地动态随着监测、资源调查、灾害预测和防治、环境保护等无不利用数字地球。随着数据的不断积累，最终将有可能使人类更好地认识和了解我们生存与生活于其上的这个星球，并运用海量地球信息对地球进行多分辨率、多时空和多种类的三维描述。

数字地球将容纳大量行业部门、企业和私人添加的信息，对按照空间和时间规律分布的大量数据进行研究和分析，例如国家基础设施建设的规划，全国铁路、交通运输的规划，城市发展的规划，沿海地带开发，西部开发。从贴近人们生活的角度看，房地产公司可以将房地产信息链接到数字地球上；旅游公司可以将酒店、旅游景点，包括它们的风景照片和录像，放入这个共用的数字地球上；世界著名的博物馆和图书馆可以将其收藏以图像、声音、文字形式放入数字地球；甚至商店也可以将货架上的商品制作成多媒体或虚拟产品放入数字地球中，让用户任意挑选。因此，数字地球进程的推进必将对社会经济发展与人民生活产生巨大的影响。

数字地球的核心是地球空间信息科学，地球空间信息科学的技术体系中最基础和基本的技术核心是“3S”技术及其集成。“3S”即全球定位系统（GPS）、地理信息系统（GIS）和遥感（RS）的统称。

空基“3S”集成（见图 1-11、图 1-12）：用空一地定位模式实现直接对地观测，主要目的是在无地面控制点（或有少量地面控制点）的情况下，实现航空航天遥感信息的直接对地定位、侦察、制导、测量等。

地基“3S”集成：车载、舰载定位导航和对地面目标的定位、跟踪、测量等实时作业。

在现代化战争和国防建设中，数字地球具有十分重大的意义：建立服务于战略、战术和战役的各种军事地理信息系统，并运用虚拟现实技术建立数字化战场，包括地形地貌侦察、军事目标跟踪监视、飞行器定位、导航、武器制导、打击效果侦察、战场仿真、作战指挥等方面；在战前建立战区及其周围地区的军事地理信息系统；战时利用 GPS、RS 和 GIS 进行战场侦察、信息的更新、军事指挥与调度及武器精确制导；战时与战后的军事打击效果评估等。



图 1-11 “3S” 集成

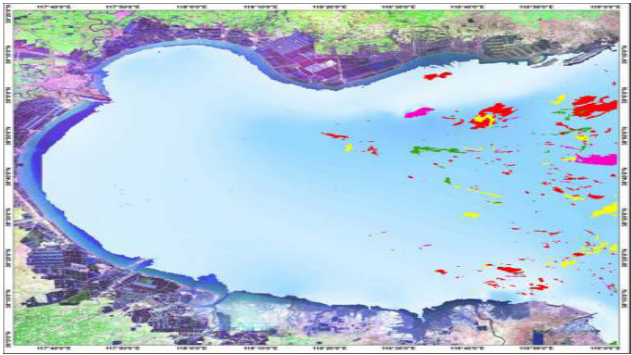


图 1-12 海洋表面油膜分类图

数字地球的未来是数字宇宙。它代表了地球人类更大发展空间和更长发展时间。

单元2 计算机系统

2.1 大数据



在当今社会，互联网、人工智能和物联网技术导致了数据具有复杂性、多样性和广泛性，大数据就是这个高科技时代的产物。

大数据是指无法在一定时间范围内用常规软件工具进行捕捉、管理和处理的数据集合，是需要具有更强的决策力、洞察发现力和流程优化能力的新处理模式才能处理的海量、高增长率和多样化的信息资产。

大数据到底有多大？美国互联网数据中心指出，互联网上的数据量每年将增长50%。一天之中，互联网产生的全部数据可以刻满1.68亿张DVD；据IDC预测，到2020年全球将总共拥有35ZB的数据量。

“大数据”时代已经来临，在商业、经济及其他领域中，决策将日益基于数据和分析而做出，而并非基于经验和直觉。数据量正在迅速膨胀并变大，它决定着企业的未来发展，大数据已成为劳动力和资本之外的第三生产力。

IBM公司提出大数据具有5V特点：Volume（大量）、Velocity（高速）、Variety（多样）、Value（低价值密度）、Veracity（真实性）。

有人把数据比喻为蕴藏能量的“煤矿”。大数据技术的战略意义不在于“大”，而在于“有用”。价值含量、挖掘成本比数量更为重要。对于很多行业而言，如何利用这些大规模数据是赢得竞争的关键。结合了大数据和高性能的分析，可对国家和对企业产生有益的帮助。大数据的应用其实早已渗透到人们生活中的方方面面：Amazon运用大数据技术为客户推荐商品信息，阿里巴巴用大数据技术成立了小微金融服务集团，当下，很多行业都开始增加对大数据的需求。大数据时代（下的我们）不仅处理着海量的数据，同时也在传播、分享它们。

电子商务、O2O、物流配送等各种利用大数据进行发展的领域正在协助企业不断地发展新业务，创新运营模式，通过数据挖掘和分析，可以非常准确地判断消费者行为、预测产品销售量和精确的营销范围、全面改善与优化存货的补给等。

大数据（的出现）是继云计算、物联网（的出现）之后IT产业又一次颠覆性的技术变革。云计算主要为数据资产提供了保管、访问的场所和渠道，而数据才是真正有价值的资产。如何盘活这些数据资产，使其为国家治理、企业决策乃至个人生活服务，是（使用）大数据的核心议题。

2012年，奥巴马政府宣布投资2亿美元拉动大数据相关产业发展，将“大数据战略”上升为国家意志。

2015 年贵州省开始建设我国首个大数据综合试验区,围绕有数据、用数据、管数据,开展先行先试,探索新的大数据应用模式,打造七大数据平台,更好地服务国家大数据发展战略(见图 2-1)。



图 2-1 贵州大数据展示中心的“时光隧道”

2016 年 3 月,中国“十三五”规划中明确提出实施国家大数据战略、加快政府数据开放共享、促进大数据产业健康发展。

大数据必将释放出更大的价值,是通往未来的必由之路。

2.2B 计算机的启动过程及其常见故障



从按下计算机启动按钮到它准备好接收输入命令的这段时间称为计算机的启动过程。启动过程大致可以分为 5 步。

- (1) 开机: 打开电源开关, 电源指示灯点亮, 电流被传输到主板和其他设备。
- (2) 执行引导程序: CPU 调入并执行 ROM 当中的引导程序。
- (3) 开始自检: 计算机开始对一些主要的硬件系统进行测试。
- (4) 装入操作系统: 操作系统从磁盘上被复制到内存中。
- (5) 准备接收命令和数据。

下面我们一起来看看计算机启动过程中的一些常见故障。

1. 开机

启动过程的第 1 步就是通电, 此时机箱上的电源指示灯应点亮。若电源指示灯没亮, (说明) 系统中就没有电流。你需要检查一下计算机背后的电源接口, 确保电源线被稳固地连接到了机箱和墙上的插座上。同时, 确保墙上的插座是有电的。如果电源指示灯依旧没亮, 则可能是计算机的电源出了故障(见图 2-3)。

当你启动一台计算机后，你应该会看到电源指示灯点亮，并听到风扇（的响声）

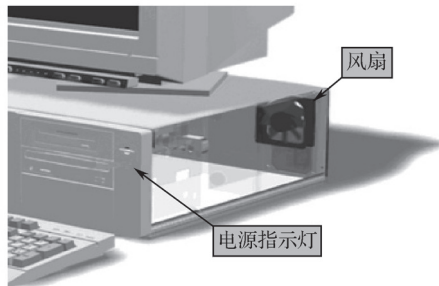


图 2-3 开机时查看电源指示灯并听风扇声音

2. 执行引导程序

ROM 中的引导程序被装入内存，CPU 开始执行引导程序。如果电源指示灯是亮的，还能听见风扇转动的声音，但是却没有任何信息显示在屏幕上，那就很可能是 ROM 出了问题（见图 2-4）。

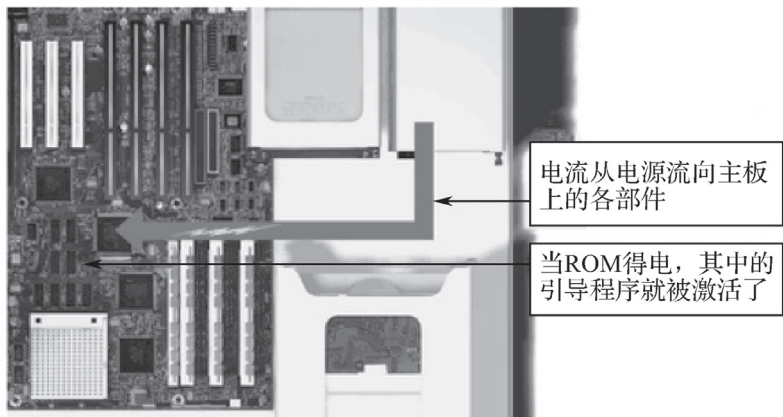


图 2-4 多数计算机在（开始）运行时会发出一次蜂鸣声

3. 开始自检

引导程序开始自检时，首先会检测显卡，如果显卡正常，你会在屏幕上看到类似“Video BIOS ver 2.1 2000”的信息。如果计算机没有显示这个信息，有可能显卡出问题了。接着计算机会检测内存，若内存出错，计算机会发出蜂鸣声。自检的最后一步是驱动器检测。你将会看见驱动器的指示灯在闪烁并听见它运行的声音。若计算机在这个检测过程中暂停，则意味着其中某些驱动器发生了故障（见图 2-5）。

4. 装入操作系统

在成功完成自检之后，计算机继续按照 ROM 中的指令装入操作系统文件。计算机

会试着从默认驱动器上查找并装入相关文件，如果显示一条信息“不是系统盘或磁盘错误”，则表示系统文件错误。如果系统文件正常，接下来 CPU 就会加载 Command.com 文件。若文件无误，计算机就可以接收输入命令了（见图 2-6）。

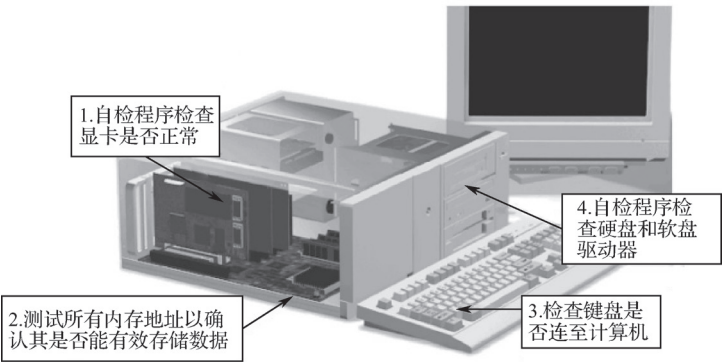


图 2-5 自检

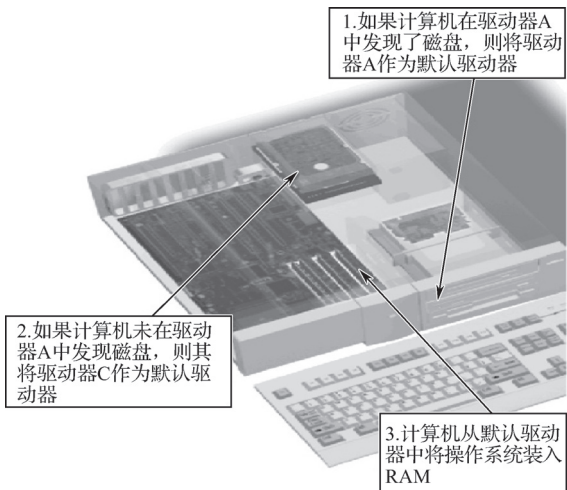


图 2-6 加载操作系统

5. 准备接收命令和数据

当引导过程结束时，操作系统桌面或提示符就会出现。如果 Windows 还不正常，你可以用安全模式启动系统，这种模式只能用于故障诊断，而不能用于执行真正的计算任务。在安全模式中排查完错误以后，就可以正常使用计算机了。

2.3B 网络编程

最早的软件都是运行在大型机上的，软件使用者通过“哑终端”登录到大型机上去运行软件。后来随着个人计算机的兴起，软件开始主要



运行在桌面上，而数据库这样的软件运行在服务器端，这种客户端 / 服务器模式被简称为 C/S 架构（见图 2-9）。

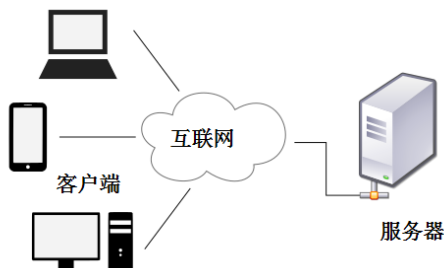


图 2-9 C/S 架构

随着互联网的兴起，人们发现，C/S 架构不适合网络应用，最大的原因是网络应用程序的修改和升级非常迅速，而 C/S 架构需要每个客户端逐个升级桌面应用程序，因此，浏览器 / 服务器模式开始流行，简称 B/S 架构。

在 B/S 架构下，客户端只需要浏览器，应用程序的逻辑和数据都存储在服务器端。浏览器只需要向服务器提出请求，获取网页内容，并把页面展示给用户即可。

当然，网页具有极强的交互性。由于网页是用超文本标记语言（HTML）编写的，而 HTML 具备超强的表现力，所以服务器端升级后，客户端无需任何改动就可以使用新的版本，因此，B/S 架构迅速流行起来。

今天，除了重量级的软件如 Office, Photoshop 等，大部分软件都以网页形式提供。比如，新浪提供的新闻、博客、微博等服务，均是网页应用。

网络应用开发可以说是目前软件开发中最重要的部分。网络应用开发经历了好几个阶段。

静态网页：由文本编辑器直接编辑并生成静态的 HTML 页面，如果要修改网页的内容，就需要再次编辑 HTML 源文件。早期的互联网网页是静态的。

CGI：由于静态网页无法与用户交互，比如用户填写了一个注册表单，静态网页就无法处理。为了处理用户发送的动态数据，出现了用 C/C++ 编写的公共网关接口，简称 CGI。

ASP/JSP/PHP：由于网络应用特点是修改频繁，用 C/C++ 这样的语言非常不适合网络开发，而脚本语言由于开发效率高，与 HTML 结合紧密，因此，（脚本开发模式）迅速取代了 CGI 模式。ASP 是微软推出的用 VB Script 编程的网络开发技术，而 JSP 用 Java 来编写脚本，PHP 本身则是开源的脚本语言。

MVC：为了解决直接用脚本语言嵌入 HTML 导致的可维护性差的问题，网络应用引入了模型—视图—控制器的模式，来简化网络开发。ASP 现已发展为 ASP.Net，JSP 和 PHP 也有很多 MVC 框架。

目前，网络开发技术仍在快速发展中，异步开发、新的 MVVM 前端技术等层出不穷。

Python 的诞生历史比网页还要早，由于 Python 是一种解释型的脚本语言，开发效率高，所以非常适合用来进行网络开发。Python 有上百种网络开发框架，有很多成熟的模板技术。选择 Python 开发网络应用，不但开发效率高，而且运行速度快。

2.4B 中央处理器和内存

中央处理器（CPU）是一块由上百亿个电子单元组成的超大规模集成电路，它相当于计算机的“大脑”。中央处理器有两个主要部件：算术逻辑单元和控制单元（见图 2-12）。



图 2-12 英特尔酷睿 i9 处理器

算术逻辑单元负责对输入内存的数据进行数值运算，并将运算的结果返回给内存供其保存。

控制单元负责连续地从内存中取出一条条指令。控制单元解释指令并找出需要完成的任务。根据它的解释，（系统）就可从内存中取得待运算数据，再送往算术逻辑单元进行运算。

CPU 的算术逻辑单元和控制单元都很重要。拥有发达的算术逻辑单元的计算机很强大，但是如果没有控制单元，再强大的计算机也只能是一个“疯了”的、“不受控制”的计算机。

内存是计算机中的“记忆中枢”，任何想送给 CPU（大脑）去处理的指令和数据必须先到达内存中排队，CPU 处理各种数据的结果一般也需要先送到内存当中，再分发给其他需要数据的计算机部件。考核内存质量的指标主要有两个：一个是速度，速度越快越好，另一个是容量，只有足够庞大的存储空间才能支持更加强大的计算机操作（见图 2-13）。



图 2-13 内存

和内存相对应的存储器叫外存，一般包含硬盘、光盘、软盘（见图 2-14）和 U 盘等。我们平常使用的程序，如 Windows 操作系统、打字软件、游戏软件等，一般都是安装在硬盘等外存上的。保存在外存上的程序是不能直接被 CPU 执行的，必须把它们先调入内存中并有序地送达 CPU，才能真正使用其功能。我们平时输入一段文字，或玩一个游戏，其实都是在内存中进行的。就好比在一个书房里，存放书籍的书架和书柜相当于计算机的外存，而我们工作的办公桌就是内存。通常我们把要永久保存的、大量的数据存储在外存中，而把一些临时的或少量的数据和程序放在内存中。因此，内存的速度与容量会直接影响计算机的运行速度。



图 2-14 软盘

单元3 信息安全

3.1 凯文·米特尼克



凯文·米特尼克（Kevin Mitnick）是世界闻名的计算机黑客。他的黑客经历的传奇性足以让全世界为之震惊，也使得绝大多数网络安全人员颜面扫地。

1977年，13岁的小学生米特尼克就成了一位令老师们惊叹的计算机天才，直到他如闲庭信步般地闯入其他学校的网络后被学校开除。后来15岁的米特尼克闯入了“北美空中防务指挥系统”的计算机主机，他和一些朋友翻遍了美国指向苏联及其盟国的所有核弹头的数据库，然后又悄无声息地溜了出来。

五角大楼对这件事一直保持沉默。事后，美国著名的军事情报专家克赖顿曾说：“如果米特尼克将这些情报卖给克格勃，他至少可以得到50万美元的酬金，而美国则要花费数十亿美元来重新部署。”

FBI认为其过于危险，于是收买了米特尼克最要好的朋友之一，诱使米特尼克再次攻击网站，以便把他抓进去。结果米特尼克“上钩”了，但他在攻破了FBI的内部网络之后发现了这个圈套，然后就和FBI开始了一段传奇式的追捕与反追捕。在逃跑过程中他通过高超的黑客技术控制了相关的网络，他在网络上随意地翻阅自己的案情资料，无情地嘲弄追捕他的警察……他每次都会比警察更先看到抓捕命令，所以可以轻松地和警察玩捉迷藏游戏，直到被当时最新式的“计算机网络信息跟踪机”追踪而被捕。

虽然只有十几岁，但他网络犯罪行为不断，被人称为是“迷失在网络世界的小男孩”。在他最后一次被捕的时候警察甚至禁止他接触半导体收音机，警察的理由是“任何电子产品在米特尼克的手上都会成为他的武器”。

巡游五角大楼（的网络），登录克里姆林宫（的相关网站），进出全球所有计算机系统——这就是少年时代的米特尼克（所做的事）。现在米特尼克是网络安全咨询师，出版过《反欺骗的艺术》《反入侵的艺术》《线上幽灵：世界头号黑客米特尼克自传》（见图3-1）等著名作品，成为了一名捍卫网络安全的斗士。

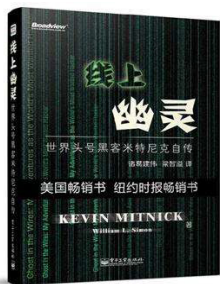


图3-1 凯文·米特尼克的著作

3.3B 王小云——击溃密码算法的中国科学家



密码学是信息安全的基石，密码是保护用户信息的钥匙。那么谁来保护密码呢？那就是“算法”（见图 3-7）。既然“算法”这么重要，那么每个国家能否制定一套自己的、永不泄露的“加密算法”来实现信息安全？答案是否定的！



图 3-7 密码学的核心是算法

比如某个国家丢失了一批重要的密码，只需要更换掉这批密码就可以避免损失的扩大；但是如果泄露了“加密算法”，那么唯有全国上下更换所有（用于生成密码的）软件才行。所以加密算法的核心不在于“秘密”，而在于“坚固”——“我明确地告诉你我的加密算法是什么，但是你就是无力破解！”

王小云是工作于山东大学的一位女教授，中国密码学家。2004 年她的研究小组已经成功破解了 MD5、HAVAL-128、MD4 和 RIPEMD 四大国际著名加密算法，几个月后她又破译了更难的 SHA-1。SHA-1 加密算法由美国专门制定加密算法的机构——美国国家标准与技术研究院和美国国家安全局设计，早在 1994 年就被推荐给美国政府和金融系统采用，是美国政府目前应用最广泛的加密算法。MD5 算法是国际“电子签名”技术的基石之一，“电子签名”的地位相当于个人在互联网上的“指纹”，被广泛应用于金融、证券等电子商务领域。专家们曾认为 MD5 算法能够保证数字签名无法被伪造。但是王小云团队随后开发的方法能够迅速匹配这些数字“指纹”，这大大出乎了国际同行们的意料。

有专家在美国《新科学家》杂志用《崩溃！密码学的危机》这样耸人听闻的文章来描述王小云里程碑式的成就。因为王小云的成果，美国国家标准与技术研究院宣布：美国政府将于 5 年内停止使用 SHA-1，取而代之的是更为先进的新算法。微软、Sun 和 Atmel 等知名公司也纷纷发表各自的应对之策。

也许有人认为这个一度让数字世界几乎无安全算法可用的女子一定过得很苦很累，但是她说：“那段时间，在我抱着孩子、做着家务的间隙，各种可能的破解算法的途径就在我脑中盘旋。我会在一段时间里拼命工作，感觉累了就休息一段时间。到现在我还怀念那 10 年的生活。”看，当爱好融入工作之后生活可以那么美！

3.4B 史上影响重大的黑客事件



虚拟网络世界错综复杂，危机四伏，稍有不慎，造成的破坏甚至比现实中的破坏还可怕，让我们了解一下史上影响重大的黑客攻击事件。

1. 逻辑炸弹在西伯利亚爆炸

1982 年，里根政府领导下的联邦调查局发现克格勃多年来从西方窃取信息。对此，美国中央情报局决定给克格勃设一个巨大的陷阱。他们当时故意泄露了一个“绝密软件”，中央情报局在软件里利用木马病毒放入“逻辑炸弹”。如果软件切换到与初始不同的模式运行 10 万个周期后，逻辑炸弹将会启动。克格勃仔细检查他们偷来的东西，并没有发现什么异常，而且这个软件对于他们来说非常有帮助，刚好可以用在西伯利亚延伸到西欧的天然气管道建设项目中。该程序在前几个月运行得很好，但是在 1982 年 6 月，美国间谍卫星侦测到发生在西伯利亚管道建设工程工地的一次非常大的爆炸。爆炸当量相当于 3 万吨 TNT 炸药，大约是投在广岛的原子弹爆炸威力的五分之一。据当时美国的内刊描述，这是“从太空看到的最巨大的非核武器爆炸”。

2. 侵入银行系统获取巨额钱财

1995 年，来自俄罗斯的黑客弗拉季米尔·列宁在互联网上演了精彩的“偷天换日”，他是历史上第一个通过入侵银行计算机系统而获利的黑客。他侵入美国花旗银行的系统并盗走一千万美元。他于 1995 年在英国被国际刑警逮捕。

3. 百度“被黑”

2010 年 1 月 12 日上午 7 点，全球最大中文搜索引擎“百度”开始遭到黑客攻击，长时间无法被正常访问。范围涉及四川、福建、江苏、吉林、浙江、北京、广东等国内绝大部分省市。这是自百度建立以来，所遭遇的持续时间最长、影响最严重的黑客攻击，网民访问百度时，会被定向到一个位于荷兰的 IP 地址，百度旗下所有子域名均无法被正常访问。

4. 比特币勒索病毒

2017 年 5 月 12 日，蠕虫病毒“想哭”通过 MS17-010 漏洞在全球范围大爆发，感染了大量的计算机，该蠕虫病毒感染计算机后会向计算机植入敲诈病毒，导致计算机大量文件被加密。受害者计算机被黑客锁定后，病毒会提示支付价值相当于 300 美元（当时约合人民币 2069 元）的比特币才可解锁文件。比特币勒索病毒全球大爆发，至少有 150 个国家的 30 万名用户“中招”，造成损失达 80 亿美元，影响到金融、能源、医疗等众多行业。中国部分 Windows 操作系统用户受到影响，校园网用户首当其冲。大量实验室数据和研究生毕业论文被加密锁定。

5. 攻击俄罗斯网站

2018年4月9日，不明黑客团伙利用思科智能安装程序的漏洞，获得了在网络设备上任意执行代码的能力。犯罪分子更换了思科网际操作系统的图像，改写了配置文件，攻击导致数据中心整体瘫痪，种种迹象表明，犯罪分子主要攻击的是俄罗斯网域，但其他国家显然也未能幸免（见图3-8）。

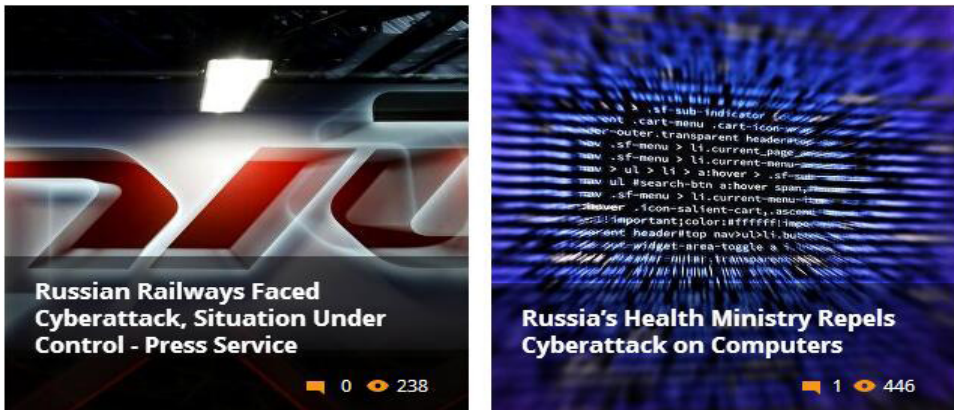


图 3-8 攻击俄罗斯重要部门网站

由此可见，虚拟世界（发生的事）也同样惊天动地，我们对网络世界应心存敬畏。魔高一尺，道高一丈，我们相信正义必将战胜邪恶。

单元4 电子电气安全

4.1 银行巨变——全球第一家无人银行

2018年4月10日，国内第一家，也是全球第一家无人银行——中国建设银行上海九江路支行在上海正式开业（见图4-1）。



图 4-1 无人银行入口

踏进银行大门的一刻，你会彻底被震撼：找不到一个保安，取而代之的是人脸识别闸机和敏锐的摄像头。

大堂经理不见了，取而代之的是会微笑、说话，对你嘘寒问暖的机器人（见图4-2）。



图 4-2 无人银行里的机器人

更找不到一个柜员，取而代之的是效率更高、懂你所要的智能柜员机。

（顾客）第一次操作时需要将手机号、银行卡和人脸识别信息进行绑定（见图4-3），

以后只要输入手机号码，再“刷脸”，就可以取款，方便快捷。无人银行里没有柜员，但90%以上现金及非现金业务都能办理。如要办理更复杂的业务，顾客带上耳机和眼镜，就可以接受远程一对一的服务。



图 4-3 人脸识别

这个“无人银行”不仅是一家银行，它还扮演了多种角色。它是一个拥有5万册书的“图书馆”，（用户用）手机一扫，就能把书保存带走；它是一个实现了AR、VR等多项技术的“交易厅”，可以显示建行App中所有可租的房子；它还是一个“小超市”，（用户）办理相关金融业务后，可在智能售货机上免费领取饮品，机器人自动拍照留念。

银行巨变从未像今天这般猛烈。不仅网点没有了人，就连网点的职能都在发生翻天覆地的变化！

可以预见，在未来的城市里，可能会仅保留几个传统人工网点，剩下的将全是这种无人银行（见图4-4）。



图 4-4 客户自助办理业务

有人在担忧老人不会操作怎么办。建行方面介绍，无人银行和网点智能化改造，让更多人力从程式化的岗位上解放出来，从而集中资源，为客户提供个性化服务，为

老年人等特殊群体提供更细致的专业服务。

“无人驾驶”“无人超市”“无人便利店”相继走红，科技公司和互联网企业纷纷走入市场。尽管从目前来看，这些“无人”场景还不够完善，但是随着科技的不断发展，中国的无人化市场会越来越丰富。

“无人银行”的推出充分展示了建行运用了生物识别、语音识别、数据挖掘等最新金融、智能科技成果，并整合融入当前炙手可热的机器人、VR、AR、人脸识别、语音导航、全息投影等科技元素。

4.2B 家庭用电安全常识

现代家庭生活离不开电力，我们应学习家庭用电安全常识，提高触电意识，保护生命财产安全。下面是一些关于家庭用电安全的常识。



(1) 认识电源开关（见图 4-9），学会在紧急情况下切断电源。

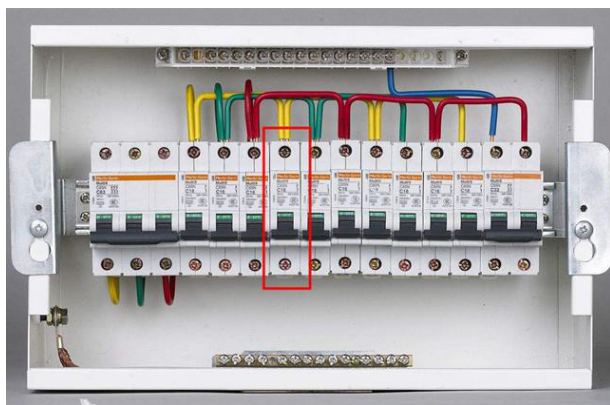


图 4-9 电源开关

(2) 不要超负荷用电。家庭用电设备的总电流不能超过电度表和电源线的最大额定电流。

(3) 安装保护器（即我们所说的熔断器）。家庭用电一定要安装具有过压跳闸、漏电跳闸双功能的保护器，如常用的空气开关，可以在家电设备漏电、人身触电、供电电压太高或太低时自动跳闸切断电源。

(4) （用户购买）家庭用电设备须选用合格产品，切勿贪图便宜购买假冒产品。

(5) 不要忘记给三相插座安装接地线，不要随意把三相插头改为两相插头。

(6) 养成好习惯：离家时、停电时、维护检查前或睡觉前先断电，电器不用时拔插头。

(7) 不用湿手触摸电器，不用湿布擦拭电器。

(8) 住宅内用电电源插座应采用安全型插座，卫生间等潮湿场所应采用防溅型插

座，以防触电和保证幼童安全。

(9) 安装家电时，要注意电器的使用环境。不要将家用电器安装在潮湿、有热源、多灰尘、易燃或含有腐蚀性气体的环境中。

(10) 平时多注意观察家电、插头、插座等，是否有破损老化现象，如果有，应及时更换。

(11) 电器损坏时，请专业人员修理，千万不可自己拆卸、拼装。

(12) 严禁使用代用品。不能用铜丝、铝丝、铁丝代替熔丝；不能用信号传输线代替电源线，不能用医用白胶布代替绝缘黑胶布。

(13) 不要移动正在运转的家用电器，如要搬动，应断开电源。

(14) 严禁私自从公用线路上接线。

(15) 遇到雷雨天气，要及时关掉电器，防止电击伤人或击坏电器。

(16) 家长要教育孩子不能玩电器。

(17) 家用电热设备、暖气设备一定要远离煤气罐、煤气管道。煤气漏气时先要开窗通风，千万不能接通电源，应请专业人员处理。

(18) 电吹风、电饭锅、电熨斗、电暖器等电器在使用中会发出高热，应注意使其远离纸张、棉布等易燃物品，防止发生火灾。使用时注意避免烫伤，用完后切断电源，拔下电源插头以防意外。

(19) 家用电器冒烟、烧焦、着火，或有异常的响声时，必须立即断电，再进行检查或灭火，切不可用水或泡沫灭火器浇喷（见图 4-10）。



图 4-10 发生电气火灾时，先断开电源后灭火

(20) 发现有人触电应先断开电源，不要带电救人。

只有掌握家庭安全用电常识，正确使用各类电器，才可以避免意外的发生，达到“安全用电、保障平安”的目的。

4.3B 预防家庭电气火灾的常见措施



电气火灾一般是指由于电气线路、用电设备以及供配电设备出现故障而释放的热能（如高温、电弧、电火花）以及非故障性释放的能量（如电热器具的炽热表面），在具备燃烧条件下引燃本体或其他可燃物而造成的火灾，也包括由雷电和静电引起的火灾。

家庭电气火灾的直接原因是多种多样的，例如过载、短路、接触不良、接地不当、电器使用不当等。家庭电气火灾不仅严重影响人们的生产、生活和工作，还直接威胁到人们的生命安全。

那么，预防家庭电气火灾的常见措施有哪些呢？

（1）选购家用电器时，购买正规厂家生产的合格产品。使用时按说明书要求正确操作。要经常检查家用电器及其线路，若发现故障，应及时维修。

（2）不用铜、铅、铁丝代替熔丝。不同时使用多台大功率的用电设备（见图 4-13）。

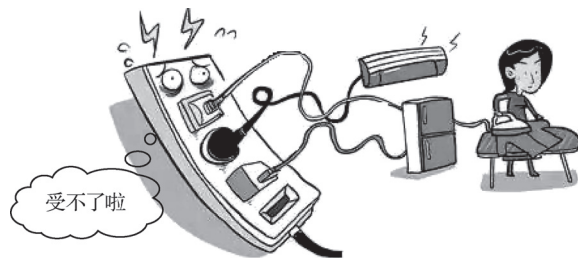


图 4-13 插座里不能插入过多插头

（3）不得乱接乱拉电线供电，不要将电线直接敷设在可燃材料上，电气线路连接要牢靠，防止松动或接触不良。

（4）正确使用电热器具。使用电熨斗时，不要长时间在衣物上熨烫，暂不使用时应将其搁置在一边，或放在专用金属架上，人离去时应立即拔去插头。

（5）电热毯应铺在平整的床板上，不宜铺在软床垫上，以防凹凸的床面折断电阻丝。严禁在卷曲和折叠的情况下通电。

（6）使用电饭煲时要保持内胆底部和电热板之间清洁干净，不得附有水点、灰尘、饭粒、杂物等。

（7）电冰箱内严禁存放易燃、易挥发的化学试剂及药品，以免其挥发后与空气形成混合气体，遇电火花爆炸起火。

（8）洗衣机洗涤衣服时，不能超量，以免电动机超负荷运行产生高温。

（9）电气设备如果因停电或其他原因断电后，一般应延时 3 到 6 分钟后，才能重新使用。

（10）如果闻到家中有煤气或液化气的臭味时，说明煤气或液化气发生了泄漏，这时不能开灯或使用其他电气设备，首先应该轻轻打开窗户，以免接触不良的开关产

生火花，引起煤气或液化气爆炸。

(11) 电器起火时，应先拔下电源插头，切断电源，可用干粉灭火器灭火。无灭火器时，可用湿棉被、棉毯将电器盖上，隔绝空气，窒息灭火。未切断电源时，切记不可用水浇，以免造成电气短路扩大火灾，或造成救火人员的触电事故（见图 4-14）。



图 4-14 不能用水灭电气火灾

(12) 睡觉前或家中无人时，要切断电视机、电热毯、电风扇等家用电器的电源。

(13) 把好装修关，应按规范把控家装设计、原材料购买、施工等环节，以免留下隐患。

(14) 可以安装电气火灾监控系统（漏电火灾报警系统），将电气火灾发生前的征兆通过技术手段转换成可识别的信息，以达到对电气火灾监控，在电气火灾发生之前发出报警信息的目的。

只有提高安全意识，掌握电气防火的基本安全常识，严格按照规定使用电器，才能有效预防家庭电气火灾的发生，充分保障家庭用电安全。

4.4B 日常生活消除静电小妙招



天气干燥时非常容易产生静电（见图 4-16），虽然静电对人体几乎没有危害，但是，静电对人体健康的确有很多负面影响。比如，一些心律失常的人无法查到器质性病变以及心律失常的原因，然而听从医生建议改穿纯棉衣服后，（他们的）心律很快就恢复正常了。下面我们来看看日常生活中简单有效消除静电的一些小妙招。

(1) 干性皮肤容易产生静电，因此，在冬春等干燥季节，可以多用保湿类化妆品，注意保持皮肤湿润，防止静电产生。

(2) 尽量穿全棉、真丝衣服，穿橡胶底的鞋，不穿化纤类服装。脱衣服之后，接触门、水龙头之前先用手摸一下墙壁，可以将体表静电“放”出去。

(3) 干燥环境有利于静电的积累。因此要保持一定的室内湿度,勤拖地、勤洒水。在室内使用加湿器,或是放置盛水的敞口容器,可以有效抑制静电产生。在室内放观赏鱼或盆栽花草也是调节室内湿度的好方法。



图 4-16 生活中的静电

(4) 平时常洗手、洗脸、洗澡和勤换衣服,能有效消除人体表面聚集的静电和带电尘埃。赤脚有利于释放体表积聚的静电,因此休闲时,可以通过赤脚释放静电。多吃酸奶、蔬菜、水果等酸性食品,多喝水,注意补充钙质和维生素 C,可以维持人体电解质平衡,减少静电产生。

(5) 带有较多静电者,不要随便去触碰他人,特别是婴幼儿、老年人、有心脏疾病和高血压的人,否则后果可能很严重;触碰前,要先消除静电。

(6) 头发带静电后,可以给头发喷水,或让梳子在水中浸湿,然后再梳理头发(以消除静电)。

(7) 为避免静电击人,可持小金属器件(如钥匙)先碰触大门、门把、水龙头、椅背、床栏等,再用手触及。

(8) 不少使用计算机的工作者脸部多发红斑、色素沉淀等面部疾病,这是由于计算机屏幕产生的静电吸引大量悬浮的灰尘,使面部受到刺激引起的。预防的办法是:当你离开计算机或关上显示器后,马上洗手洗脸,让皮肤表面上的静电在水中被释放掉。

(9) 电热吹风机、冰箱、洗衣机等电器的外壳也可携带静电。为了保证安全,必须将冰箱、洗衣机外壳妥善接地,这样做还能够防止因电器外壳漏电导致的伤亡事故。

(10) 尽量避免使用化纤地毯和以塑料为表面材料的家具家电,防止摩擦起电。

(11) 在暖气下放置一盆水,用吸水好的布,一头放在水里,一头搭在暖气上,整个房间就会湿润宜人,减少了静电产生的可能性。

(12) 长期待在室内,静电容易积累,可以多到户外活动,把室内静电尽量释放到空气中。

(13) 冬天少戴耳机。如果人体静电比较多，静电会通过耳机释放到耳道，损害耳部。

(14) 带一小喷雾瓶，随时喷一下，一小瓶自来水够用一天。

综上所述，对付静电，我们可以采取“防”和“放”两种办法。“防”就是尽量不用容易起静电的物品以及要注意室内经常通风换气。“放”就是要增加湿度，使局部的静电容易被释放。

单元5 电工电子技术

5.1 深度学习之父



多伦多大学计算机系教授杰弗里·辛顿是深度学习的开山鼻祖，2013年，谷歌为了让杰弗里·辛顿为他们工作，专门花几千万美元收购了多伦多大学的一家只有三个成员的初创公司——DNN 研究公司。我们来讲讲他的故事。

何为深度学习？深度学习专门研究用计算机模拟人脑的计算机神经网络，以其模拟或实现人类的学习行为，使其跟人类一样，具备自我学习能力。

比如一个广为流传的例子就是：谷歌用 1.6 万块计算机处理器构建了全球最大的电子模拟神经网络，并通过向其展示自 YouTube 上随机选取的 1000 万段视频。在无外界指令的自发条件下，该人工神经网络自主学会了识别猫的面孔。

自从 2006 年被提出后，深度学习极大地推动了语音识别、视觉呈现、自然语言处理等方面的进展。

在剑桥大学学习心理学时，杰弗里·辛顿了解到人类大脑有数十亿个神经细胞，它们之间通过神经突触相互影响，形成极其复杂的相互联系。神经到底是如何进行学习的？这是他一直想研究的问题。

这个问题在他的努力下已经取得了部分进展。他和伙伴们建立了一层层互相连接的人工神经元模型，模仿大脑的行为，处理视觉和语言等复杂问题。

在 80 年代初，计算机性能还远远不能处理人工神经网络(ANN)需要的巨大数据集，对人工神经网络的研究在经历短暂的火热后，就陷入了低潮。

在之后的二十几年，虽然还是有一些研究人员坚持对人工神经网络的研究，但整个学术界关于人工神经网络的研究基本陷入了停滞，研究人员拿不到相关的科研基金。与人工神经网络有关的优质论文发表量极少。连著名的学术会议——神经信息处理系统进展大会(NIPS)——都变成基本与人工神经网络无关的会议。

杰弗里·辛顿的学术生涯也像人工神经网络的发展一样起起伏伏，所幸，他一直没有放弃对人工神经网络的研究。杰弗里·辛顿和他的伙伴们为实现自己的想法，定期聚集在一起召开研讨会，构建了更强大的深度学习算法，操作更大的数据集。

然而，学术圈依旧对人工神经网络的研究不感兴趣，他们的研究也很难申请到科研经费。学术圈的冷落其实不无理由，人工神经网络的很多成果很难用数学予以解释或者证明，大家只是在不断调整参数，改善算法，以得到更好的结果。

事情的转机出现在 2006 年左右，杰弗里·辛顿和他的学生们发明了用 GPU 来优化

人工神经网络的工程方法，并在《科学》和相关期刊上发表了论文，首次提出了“深度信念网络”的概念。他给多层神经网络相关的学习方法赋予了一个新名词——“深度学习”。

随后对深度学习的研究大放异彩，（其成果）广泛应用在图像处理和语音识别领域。比如杰弗里·辛顿的学生就用深度学习算法赢得 2012 年的 ImageNet 比赛。

互联网的巨头开始注意到他们，这个领域迅速火热起来。离人工智能最近的互联网公司敏锐地发现了这一机遇。从 2011 年开始，深度学习算法的成熟令人工智能技术实现飞跃，包括微软、苹果、谷歌、脸书、国内“BAT”在内的企业都开始深度布局人工智能和深度学习，试图把握风口，成为下一个产业变革的巨擘。

5.2B 串联电路和并联电路



串联电路

电路元器件可以通过多种不同的方式连接起来。最简单的两种连接方式是串联和并联，而且这两种（连接方式）很常见。串联电路中电流通过一个单一的路径，所以流过所有元器件的电流都相同。

一个仅由串联元器件组成的电路被称为串联电路（见图 5-4）。

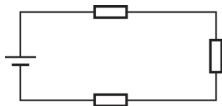


图 5-4 串联电路

串联电路中，电流只能流过一条路径，电流流过电路中的每个元器件。

（1）电压：

$$U = U_1 + U_2 + \cdots + U_n$$

串联电路中，总电压等于各元器件电压之和。

（2）电流：

$$I = I_1 = I_2 = \cdots = I_n$$

串联电路中，流过所有元器件的电流相等。

（3）电阻：

如图 5-5 所示，串联电路总电阻等于各元器件电阻之和。

$$R_{\text{total}} = R_1 + R_2 + \cdots + R_n$$

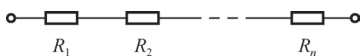


图 5-5 串联电路总电阻

并联电路

一个全部由并联元器件组成的电路叫并联电路（见图 5-6）。并联电路中，每个元器件两端的电压相等，总电流等于流过每个元器件电流之和。如果两个或多个元器件并联连接，则它们两端的电动势（电压）相等，并且，还有完全相同的极性。

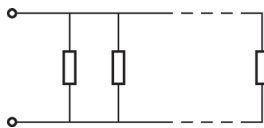


图 5-6 并联电路

（1）电压：

并联电路中，所有元器件电压相等。

$$U = U_1 = U_2 = \cdots = U_n$$

（2）电流：

$$I = I_1 + I_2 + \cdots + I_n$$

总电流等于单个元器件电流之和。

（3）电阻：

流过单个电阻的电流可以根据欧姆定律计算得知。

$$I_{\text{total}} = U \left(\frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n} \right)$$

（由上式）得知，所有元器件的总电阻的倒数等于每个电阻的倒数之和。总电阻总是小于最小电阻的阻值。

$$\frac{1}{R_{\text{total}}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots + \frac{1}{R_n}$$

5.3B 基尔霍夫电流定律

我们现在准备来研究以古斯塔夫·罗伯特·基尔霍夫命名的两个定律中的第一个。基尔霍夫是一位德国大学教授，出生在欧姆正在从事其实验工作的年代。这个公理性的定律被称为基尔霍夫电流定律（KCL），它可被简述为：流入任何一个节点的各支路电流代数和为零。

这个定律用数学的方式说明一个事实，即：电荷不能在单一节点累积。节点不是电路元器件，它当然不能存储、消耗或产生电荷。因此，电流相加必然为零。这里用水流来进行对比分析，例如，假设三个水管中的水流入点 Y。如果我们让水一直流动，则水管就会因压力持续增加而爆裂。水的实际流动方向就是我们定义非独立电流方向的例子。因此，对于连至同一点的多个电流，其中一部分必须被定义为负。



如图 5-9 所示，流入节点的 5 个电流的代数和必等于零：

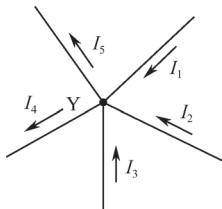


图 5-9 KCL 应用实例

$$I_1 + I_2 + I_3 + (-I_4) + (-I_5) = 0$$

显然，这个定律用于计算流出这个节点的电流代数和也可以：

$$(-I_1) + (-I_2) + (-I_3) + I_4 + I_5 = 0$$

我们也可以将其理解为流入节点的电流之和与流出节点的电流之和相等：

$$I_1 + I_2 + I_3 = I_4 + I_5$$

上式简要说明了流入的电流之和必定等于流出的电流之和。

基尔霍夫电流定律的简略表述式如下：

$$\sum_{n=1}^N I_n = 0$$

它是下式的简略表达式：

$$i_1 + i_2 + \cdots + i_n = 0$$

不难理解，等式中， N 条电流不可能全部指向节点，或者全部背向节点。例如，在如图 5-10 所示的电路中，假设已知流过 E_1 的电流为 $2A$ ，计算流经电阻 R_3 的电流。

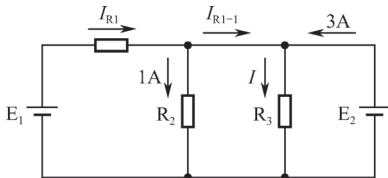


图 5-10 基尔霍夫电流定律的应用

确定问题：电路图中，已经标明流过电阻 R_3 的电流为 I 。

收集已知条件：流过 R_3 上方节点的电流来自其他支路。所有流入这个节点的电流加在一起形成电流 I 。

决定哪个方法最适用：我们从流过 R_1 的电流着手，以便写出 R_2 和 R_3 上方节点的 KCL 方程。

建立相应方程：将流入该节点的电流相加

$$I_{R1}-1-I+3=0$$

确定是否需要额外条件：可见，我们建了一个方程，却有两个未知数，这意味着我们需要增加一个方程。对于这一点，我们知道 E_1 提供 2A 电流。KCL 表明这也是流过 R_1 的电流。

尝试求解：代入，我们得到：

$$I=2-1+3=4\text{ (A)}$$

验证结果：结果是合理的或（我们）所期待的吗？

我们的复查工作往往是有价值的，我们也会试着弄清楚这个结果是否至少是合理的。在这个例题里，有两个电源：一个提供 2A 电流，另一个提供 3A 电流。没有其他受控的或独立的电源。因此，在这个电路中找不到超过 5A 的电流是正常的。

5.4B 逻辑门



1. 与门和与非门

“与”和“与非”函数是基本的两种逻辑函数，这两个函数的特点在于它们是互补的，即在功能上是相反的。

与门的数字逻辑功能是（只有）当它所有的输入为高电平时，它的输出（才）为高电平。图 5-12（a）为与门的符号，它有两个输入端 A 、 B 和一个输出端 C 。门电路最多可以有 8 个输入端。

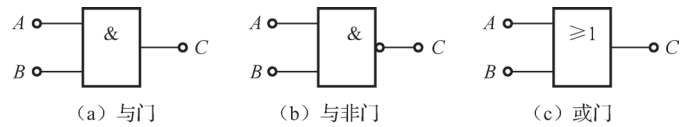


图 5-12 门的符号

当与门的两个输入均为高电平 (1) 时，则它才输出高电平 (1)。这个关系通常可以写成：

$$C=AB$$

这个表达式可以被描述成：当 A 等于 1 且 B 等于 1 时，则 C 等于 1。

与非门的符号如图 5-12（b）所示，它比与门应用更普遍，它和与门是互补的，即逻辑上它的输出和与门相反。因为与非门的电路实现比较简单，所以它比与门便宜，使用也很方便。在（英文名称中）AND 前面的字母 N 意味着“非”。

逻辑表达式中对与非门也有不同的表示法，常在字母上加一个上画线来表示非的关系。如：

$$C=\overline{AB}$$

它表示“ C 等于 A 与 B 的结果取非”。大部分情况下与非门的输出都为高电平 (1)，只有当所有的输入都为高电平 (1) 时，与非门的输出才为低电平 (0)。

2. 或门

或门的符号如图 5-12 (c) 所示。或门的逻辑功能是只要有输入为高电平 (1) 时，它就输出高电平 (1)，这种逻辑功能通常可写成：

$$C=A+B$$

加号 (+) 意味着“或”，这种逻辑关系可被表述成：“如果 A 或 B 至少有一个等于 1，则 C 等于 1”。

3. 组合逻辑门

逻辑门就像积木（构造块），如果只需要（表达）一个单一逻辑关系，可以只用它们中的一个，但要实现更复杂的逻辑运算时，它们也可以互相结合构成组合逻辑门。有时用一种逻辑门去代替别的逻辑门效果更好，设计者可以用手边的逻辑门电路来实现各种电路，这体现了组合逻辑门（电路）的多功能性和灵活性。

单元6 设备和工具

6.1 中国首款拥有自主知识产权的大型客机——C919

2017年5月5日,在异常繁忙的浦东国际机场,人们屏住呼吸,深情远眺。一架机身涂有蓝天和绿地的客机,轻盈地舒展青春的双翼,稳健地降落在第四跑道上。我国第一款按照最新国际适航标准研制,具有完全自主知识产权的干线民用飞机首飞成功!这标志着萦绕中华民族百年的“大飞机梦”终于取得了历史突破(见图6-1)!这款飞机的名字就是C919!“C”既是“COMAC”(中国商用飞机有限责任公司,简称中国商飞)的第一个字母,也是中国的英文名称“CHINA”的第一个字母,体现了大型客机是国家的意志、人民的期望;第一个数字“9”寓意天长地久;“19”代表C919大型客机最大载客量为190人。C919客机属于中短途商用飞机,实际总长为38米,翼展为20米,高度为12米,其基本型布局设168座。标准航程为4075公里,最大航程为5555公里,经济寿命达9万飞行小时。



图 6-1 C919 首飞成功

C919大型客机按照更加先进的技术标准设计,采用世界领先的动力、航电、飞控系统,完全按照国际适航标准设计生产,安全性有充分保障,彰显了我国航空工业的整体科技实力和“中国智慧”。在C919的设计研制过程中产生了多项重大技术突破,比如首次成功应用3D打印钛合金零件及超临界机翼的设计等。这是中国科研人员第一次自主设计超临界机翼,(第一次设计的成果)就达到了世界先进水平,得到了国际同行的认可。

设计人员在C919大型客机的减重、减阻设计方面花了大力气,使得巡航燃油消耗

率（SFC）大大降低，经济性竞争优势明显；外场噪声满足国际民航组织（ICAO）第四阶段噪声要求并仍有余地，氮氧化物排放量比国际民航组织（ICAO）CAEP6 要求低 50%，具有很好的环保性。C919 大型客机的宽大机身将提供给旅客更多乘坐空间，同时采用高效空气过滤系统提供高品质新鲜空气，客舱照明采用人性化情境照明设计，给乘客温馨、体贴、舒适的环境。

2017 年 11 月 10 日，第一架 C919 大型客机首次远距离飞行，从上海浦东机场飞至西安阎良机场。中国商飞开始进入下一步的研发试飞和适航取证工作。2017 年 12 月 17 日，第二架 C919 大型客机完成首次飞行，这意味着 C919 大型客机逐步开始了全面试飞的新征程。截至 2018 年 3 月，中国商飞已获得了来自全球 28 家客户的共计 815 架的订单。

未来，伴随着 C919 大型客机项目的推进和我国喷气式客机的批量生产，我国民用航空产业链将逐步发挥出巨大的经济潜力，必将显著改善我国民用航空工业基础面貌。

6.2B LabVIEW 虚拟仪器



如果你是一名工程师，那么在工作过程中你肯定会用到许多专业仪器来完成各种工作。首先，你得花上一大笔钱去买各种仪器仪表，其次，你还得在每次工作中请人扛上这些昂贵的设备去现场测试。现在，可以不用这么麻烦了，因为虚拟仪器已经走向市场。你可以只背上笔记本式计算机，笔记本式计算机里安装好所需要的虚拟仪器软件，包里再装上几个配套测控硬件就可以轻松完成工作。

1986 年，美国国家仪器公司（NI，National Instruments）发布了运行在 Macintosh 平台上的 LabVIEW 1.0，标志着虚拟仪器的问世，引发了传统仪器领域的一场重大变革；使得计算机和网络技术得以进入仪器领域，和仪器技术结合起来；从而开创了“软件即是仪器”的先河。凭着美国国家仪器公司几十年坚持不懈的努力和对研发与生产的专注，LabVIEW 虚拟仪器成为了当之无愧的行业领导者（见图 6-3）。

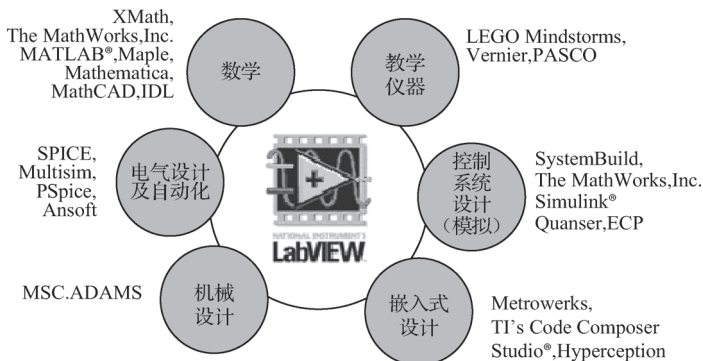


图 6-3 LabVIEW 应用介绍

LabVIEW 开发环境集成了工程师和科学家快速构建各种应用仪器所需的所有工具。利用计算机强大的数据处理功能，用户可以根据自己的需要定义和制造各种仪器。你可以像搭积木一样自由发挥，创造出你心目当中最完美的仪器（见图 6-4）。

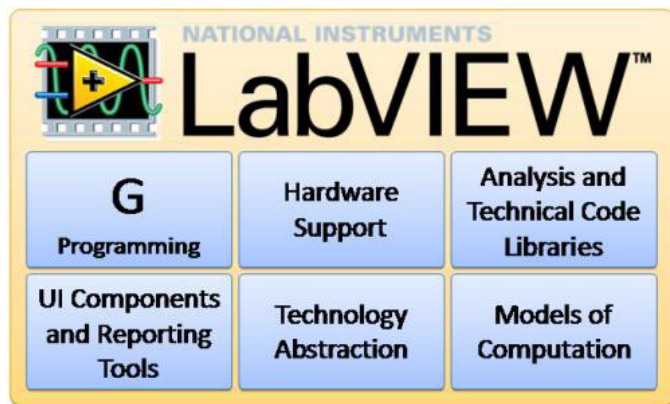


图 6-4 LabVIEW 提供的“积木”

最能突出 LabVIEW 优势的应用领域如下：

1. 测试和测量领域

LabVIEW 最早就是为了测试和测量而被开发的。大多数测试仪器、数据采集设备都拥有专门的 LabVIEW 驱动程序，用户也可以十分方便地找到各种适用于测试和测量领域的 LabVIEW 工具包。用户有时甚至只要简单地调用几个工具包中的函数，就可以组成一个完整的测试或测量虚拟仪器。

2. 控制

控制与测试是两个相关度非常高的领域，从测试领域起家的 LabVIEW 自然而然地首先拓展至控制领域。LabVIEW 拥有专门用于控制领域的程序功能模块。除此之外，工业控制领域常用的设备通常也都带有相应的 LabVIEW 驱动程序。使用 LabVIEW 可以非常方便地编制各种控制程序。

3. 仿真

例如在设计机电设备之前，可以先在计算机上用 LabVIEW 搭建仿真模型，验证设计的合理性，找到潜在的问题。在高等教育领域，有时可以使用 LabVIEW 进行软件模拟，以达到与实际同样的效果，使得学生在没有实际仪器时，也不致失去实践的机会。

4. 儿童教育

由于图形容易吸引儿童的注意力而且比文字更容易被理解，对于没有任何计算机

知识的儿童而言,可以把 LabVIEW 理解成一种特殊的“积木”。把不同的积木搭在一起,就可以实现自己所需的功能。“乐高积木”就是使用 LabVIEW 编程语言设计而成的。儿童可以轻松利用乐高积木搭建各种车辆、轮船、机器人等,再使用 LabVIEW 编写控制其运动和行为的程序。除了应用于玩具,LabVIEW 还有专门供中小學生使用的版本。

总之,LabVIEW 已经超越了仪器、工作和生活的界限,有人甚至说:“我发自内心地感谢 LabVIEW,是它让我在退休前乃至退休后都不会感到寂寞和孤独。”

6.3B 示波器



示波器是一种用途十分广泛的电子测量仪器。它能把肉眼看不见的电信号变换成看得见的图像。我们可以利用示波器观察各种不同波形、幅度随时间变化的信号的曲线,还可以用它测试各种不同的参数,如电压、电流、频率、相位差、调幅度等。凡可以产生电效应的周期性物理过程都可以通过示波器的显示屏被直接观测。

按测量所使用的技术不同,示波器可分为两大类:模拟示波器和数字示波器。

模拟示波器根据测试信号来产生电子束,并用电子枪将电子束发射到屏幕上。屏幕的内表面涂有荧光物质,被电子束打中的点就会发光。电子束就像一支笔一样在屏幕上“画出”代表被测信号瞬时值的波形曲线,其工作原理和老式的阴极射线显像管电视机(见图 6-7)几乎一样。



图 6-7 老式阴极射线显像管电视机

数字示波器则是采用数据采集、数模转换、软件编程等一系列技术制造出来的高性能示波器。数字示波器的工作方式是通过模数转换器(ADC)把被测电信号转换为数字信息。数字示波器捕获波形的一系列样值,并对样值进行存储,存储限度以判断累计的样值是否能描绘出波形为准。随后,数字示波器重构波形。数字示波器可以分为数字存储示波器(DSO)、数字荧光示波器(DPO)和采样示波器。

对于大多数的电子应用(场合),无论模拟示波器(见图 6-8)还是数字示波器(见图 6-9)都是可以胜任的。模拟示波器的性能升级需要对带宽、示波管、垂直放大和水

平扫描（的水平或性能）进行全面提升。如果要改变数字示波器的带宽，提高前段数模转换器的性能即可，对示波部分和扫描电路没有特殊要求。此外，数字示波器还具备充分利用记忆、存储和处理以及多种触发和超前触发的能力，自 20 世纪 80 年代以来，数字示波器异军突起，成果累累，大有全面取代模拟示波器之势，模拟示波器很快就会从前台退到后台。

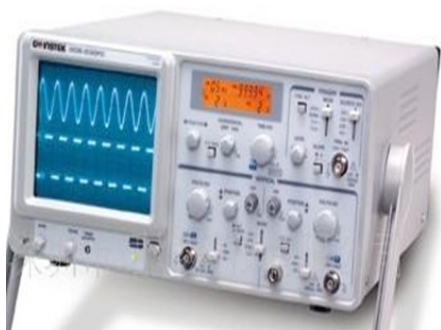


图 6-8 模拟示波器



图 6-9 数字示波器

6.4B 更专业的线缆测试仪器——Fluke1800



是否一根可以连通的并通过双绞线测试仪测试的线缆一定就符合计算机网络行业标准呢？不！对于网络介质来说，计算机网络行业有更加严谨的标准，测量（其质量）需要更加精密的仪器。接下来要了解的是更加专业的线缆测试仪器——Fluke1800，如图 6-14 所示。



图 6-14 Fluke1800

福禄克（Fluke）公司创造和发展了一个特定的技术市场，为各个工业领域提供优质的测试和检测故障的产品，并把该市场提升到重要地位，计算机网络测试产品只是

它庞大业务的一个部分。它的总部设在美国华盛顿州的埃弗里德市，工厂分别设在美国、英国、荷兰和中国。它的销售和服务分公司遍布全世界 100 多个国家。

Fluke1800 测试的对象不仅仅是一根网线，而是一个完整的数据链路。它所测试的网络介质也不仅仅是双绞线，还包含光纤。

Fluke1800 可测试的第一大类项目是“接线方式”，接线方式显示了双绞线中 8 根线芯的连接状态。接线方式有正常、开路、短路、断路、跨接（见图 6-15）、串绕共 6 种形态，只有第一种形态是正确的。

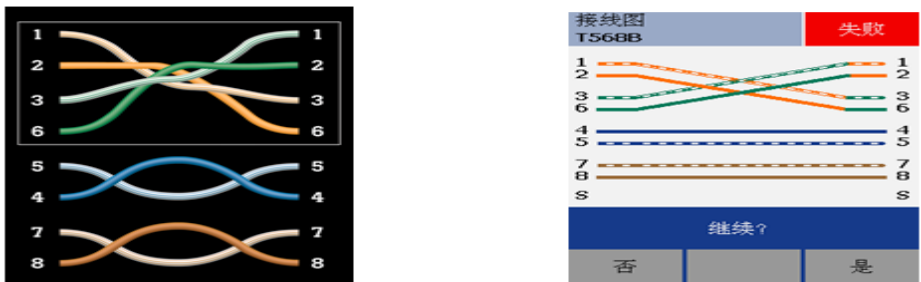


图 6-15 错误状态（跨接）

Fluke1800 可测量的第二大类项目是“电气参数”，总共有数十项参数可以被测量，其中较常见的几项有衰减、插入损耗、回波损耗、近端串扰等。如图 6-16 所示是插入损耗的测试结果。插入损耗是指一个线缆连接器插入网络接口后所导致的能量损耗，近端串扰是指双绞线的一对线芯对另外一对线芯所产生的干扰。

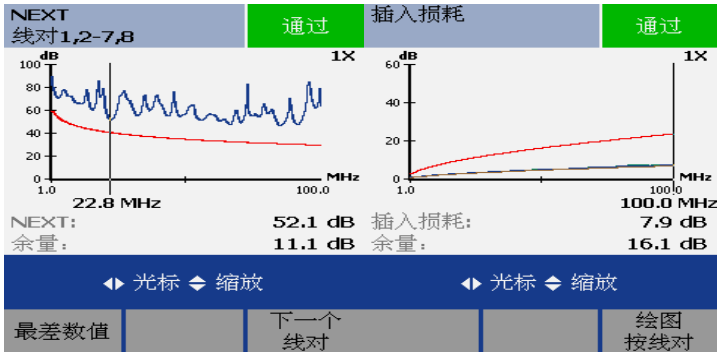


图 6-16 插入损耗

总之，对于一个网络工程的验收来说，每一个数据链路都要经过该仪器测试其数十项参数，只要其中有一个参数不合格，这个工程就不能顺利通过工程验收。

单元7 现代通信

7.1 “墨子号”量子通信卫星



现代通信一直为信息安全问题所困扰。量子通信是现代通信技术这个皇冠上最闪亮的一颗明珠，因为它彻底解决了信息传输的安全问题。

量子通信卫星的工作原理是利用量子纠缠进行通信。量子纠缠是一种量子力学现象，处于量子纠缠状态的一对某种基本粒子（如：光子）不管距离多远，如果其中一个状态发生改变，另一个也必然发生相应的变化。这个效果是无视距离的瞬时效果，敌人根本没有拦截、监听和破解（量子通信）的机会，因此量子通信彻底解决了信息传输的安全问题。

2001年，中国科学家潘建伟和他的同事们萌生了建立“世界一体化”量子通信网的初步构想。

2003年，潘建伟（领导的）团队制备出成对的处于量子纠缠状态的光子，并把这对光子分别发送到相距13公里的两个地方完成了量子通信。

2011年，中科院正式启动全球首颗“量子科学实验卫星”的研制。

2012年，潘建伟等人在国际上首次成功实现百公里量级的自由空间量子隐形传态和纠缠分发。

2016年8月16日凌晨1时40分，我国酒泉卫星发射中心用长征二号运载火箭成功将中国首个也是世界首个量子科学实验卫星“墨子号”发射升空，并使其成功入轨运行。这使得我国成为世界上首个实现在太空和地面之间进行量子通信的国家。我国的量子通信技术终于后来居上，达到世界先进水平。

墨子是中国历史上著名的思想家，他最早提出光线沿直线传播（的理论），并设计了小孔成像实验。我们用“墨子号”来命名世界首颗量子通信卫星以纪念他的伟大贡献。

2017年1月18日，“墨子号”圆满完成了4个月的在轨测试任务，被正式交付用户单位使用。6月16日，“墨子号”首次实现了（跨距达）1000公里的量子通信。8月12日，“墨子号”又成功实现千公里级的星地双向量子通信。至此，“墨子号”量子卫星提前、圆满完成了预先设定的全部三大科学目标。

2018年1月，（墨子号）在中国和奥地利之间首次实现跨距7600公里的洲际量子密钥分发（原理见图7-1），并利用共享密钥实现了加密数据传输和视频通信。该成果标志着“墨子号”已具备实现洲际量子加密通信的能力。

中国“墨子号”量子通信卫星开创了世界先河，是中国人民的骄傲，它必然给世界各国的国防、金融、商业等领域带来巨大影响。我国下一步还计划发射“墨子二

号”“墨子三号”卫星，力争在 2030 年前后建立首个全球化的量子通信网络。

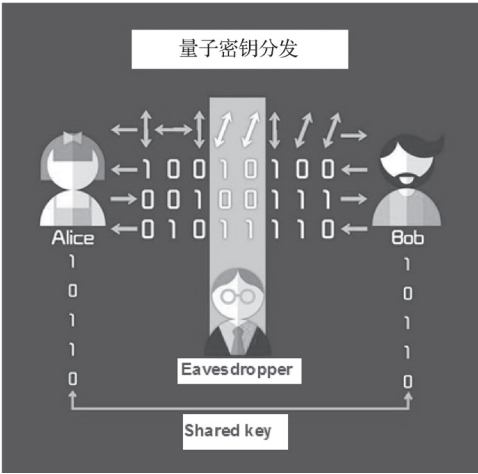


图7-1 量子密钥分发

7.2B 全球定位系统



美国的全球定位系统（GPS）是一个由 24 颗卫星组成的覆盖全球的卫星系统。这个系统可以保证在任意时刻，在地球上任意一点都可以同时观测到（该系统的）4 颗卫星，保证卫星可以采集到该观测点的经纬度和高度，以便实现高精度导航、定位、授时等功能。

GPS 起始于 1958 年美国军方的一个项目，于 1964 年投入使用。20 世纪 70 年代，美国陆海空三军联合研制了新一代卫星定位系统，主要目的是为陆海空三大领域提供实时、全天候和全球性的导航服务，并用于情报搜集、核爆监测和应急通信等一些军事目的，是美国独霸全球战略的重要组成部分。

20 世纪 80 年代开始，GPS 被允许全球商用。GPS 可以独立于任何电话网络或互联网进行工作。任何 GPS 信号接收器都可以自由访问该系统，该系统为全球各国用户提供了极大的方便。我们来看看假如现在突然没有了 GPS，会发生哪些混乱呢？

- （1）大量装有 GPS 导航系统的车辆、船只、飞机迷失方向。
- （2）物流系统崩溃，对重要车辆和货物运输的跟踪失效。
- （3）军事指挥系统失灵，精确制导导弹再也不能被制导。
- （4）整个物联网行业崩溃。

.....

结论是：我们现在已经离不开全球卫星定位技术。

当初美国为了某种目的而在 GPS 的民用信道中故意地加入了干扰信号以降低其精度。不过在 2000 年 5 月，当时的美国总统比尔·克林顿下令取消干扰。取消干扰首先

是因为 GPS 的垄断地位短期内不会被挑战；其次是彰显了美国对自己技术的自信：美国有能力对某一特定地区的 GPS 信号进行干扰以阻止敌方使用 GPS，并保护美军使用 GPS 的能力。

为了自己的战略安全，世界各国都在尽自己的能力发展卫星定位系统。俄罗斯于 1982 启动全球导航卫星系统（GLONASS）项目，预计共发射 24 颗卫星。伽利略卫星导航系统是由欧盟研制和建立的全球卫星导航定位系统。到 2016 年 12 月，已经发射了 18 颗工作卫星，全部 30 颗卫星计划于 2020 年发射完毕。印度开发的区域导航卫星系统 NAVIC 由于技术能力有限，目前只能覆盖印巴地区。日本准天顶卫星导航系统 QZSS 的 3 大主要系统功能为：GPS 系统补充、GPS 系统精度增强、报警服务。目前，中国的北斗卫星导航系统已发展至第三代，截至 2018 年 2 月 12 日，共有 29 颗北斗卫星被发射。预计到 2020 年左右，北斗卫星发射数量将达 35 颗。

7.3B 全光网络



现代通信网络的发展经历了第一代（电缆网络）及第二代（光电混合网络），现在已发展到第三代（全光网络）。所谓全光网络是指信号只在终端设备上才进行电—光和光—电转换，而在网络中传输和交换的过程始终以光的形式进行。

1. 全光网络的基本结构

我们身边的计算机和手机等终端设备都用电信号来处理信息。终端设备要用转换器将自己产生的电信号转换成光信号输入“光纤”（见图 7-5），完成信号传输（如图 7-6 所示的“发射机”和“接收机”就是转换器的工作模块）。

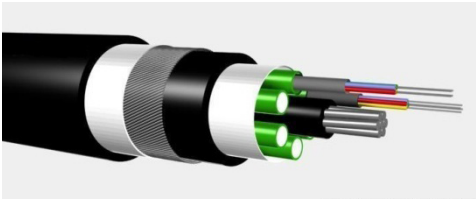


图 7-5 光纤的结构

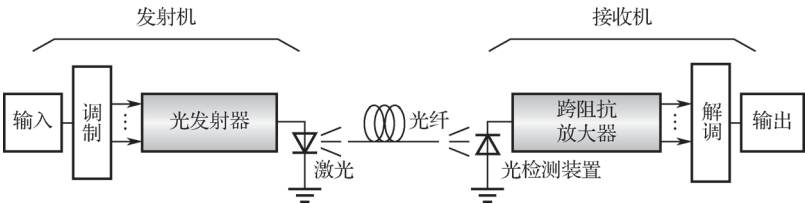


图 7-6 光通信系统

2. 全光网络的主要特点

1) 传输速率高

现在的铜缆网络带宽一般可达每秒几十兆（比特），将来也许会更好一点，但是铜缆网络具有干扰严重、成本高、易老化等不可克服的缺点。全光网络可轻松实现千兆网和万兆网连接，而且没有铜缆网络的那些缺点。

2) 传输距离长

如果使用传统铜缆网络，最远数百米就需要建立中继站进行信号中继，而目前的全光网络（电信骨干网）一般几十公里才需要中继一次。

3) 材料成本低

远距离单模光纤一般采用玻璃纤维制造，其主要成分为二氧化硅，材料便宜、环保。在“最后一公里”接入网部分，现在广泛采用了无源光网（PON）接入技术，简化了线路结构，也节约了成本。

4) 保密性能好

光在光纤中传输不会像（电信号）在铜缆中传输那样发射出电磁波，所以其保密性能极好。同时，全光网络还具有设备体积小、重量轻、结构简单、易于升级以及光缆的敷设方式方便灵活等优点。

全光网通信技术是光纤通信领域的前沿技术，是 21 世纪真正的高速公路。许多国家都把全光网络作为建设“信息高速公路”的基础，将其地位提升到战略高度。

2001 年 9 月，上海首先开通全光通信网络，2015 年 9 月，四川成为全国首个“全光网省”。2016 年，国内新建光缆线路长度再创新高，达到 5,540,000 公里，已建光缆线路累计总长度达到 30,410,000 公里，位居世界前列。

2017 年，中国提出并实施“宽带中国”“提速降费”等政策，大力促进了我国全光网络建设。

7.4B 互联网通信



互联网通信是通过网络将各个孤立的设备进行连接，通过信息交换实现人与人、人与计算机、计算机与计算机之间的通信。

和所有技术（尤其是涉及互联网的技术）一样，在线通信的方法也是在不断发展的。近年来，互联网通信的主要方式包括即时通信（图 7-8）、电子邮件（图 7-9）、网络通话（图 7-10）、网络电话、视频会议（图 7-11）、短信服务和无线通信等。

互联网通信有很多优点，只要你已支付互联网服务费用，你就可以通过发送即时消息或用网络 IP 电话进行通信而省去打普通电话的费用。当然，没有一种技术是无缺点的，网络通信也有很多缺点，比如（易感染计算机）病毒、易泄密和垃圾邮件泛滥。

即时通信可以被当成两个或更多人之间的计算机文字会议。即时通信服务器可以

创建个人聊天室,使你和另一个人在网上实时聊天。一般即时通信系统还有提醒功能:当你的好友或联系人上网时提醒你,你就可以开始和某个人聊天。



图 7-8 即时通信



图 7-9 电子邮件



图 7-10 网络通话



图 7-11 视频会议

网络电话系统由硬件和软件组成,你可以用互联网作为通话的传输媒介,对已经可以免费或固定计费(如包月、包年)上网的用户,网络电话软件提供了可打给世界各地的免费电话。

电子邮件通过互联网来传输信息。通过使用一个电子邮箱,你可以发送电子邮件。无论何人,只要你知道他的电子邮箱就可以给他发电子邮件。一封电子邮件一般只要几秒钟就可以到达目的地。(我们可以)通过电子邮件对一群人同时发信息或传送文件(群发),这是一种与一群人通信的特别有效的方式。

视频会议是指两个或更多不在同一地方的人通过以计算机网络传递声音和视频数据的方法在一起开会。每个参会者都有一个视频设备、话筒和扬声器与计算机相连接。当两个参会者互相讲话时,他们的声音通过网络被传送给对方,一方视频设备拍摄到的画面显示在另一方计算机屏幕上。

所有这些互联网通信方式使得人们的生活和工作变得更加快捷、方便、经济。

单元8 智能制造

8.1 为“国之重器”保驾护航——数控维修专家胡明华

“技术宅”是一个时髦的词，形容那些将“宅”的内容与现实与自己相关的行业或技术高度融合的“牛人”们。胡明华当一个“技术宅”已有近 20 年了。胡明华于 1994 年毕业于四川工程职业技术学院后留校任教。如今，作为四川工程职业技术学院智能控制研究所副所长的胡明华还有另一个身份，即高端数控设备控制部件的“诊疗大师”。他时常“妙手回春”，使一些因为控制元器件损坏而“瘫痪”或被“宣布死亡”的数控设备“获得新生”。2018 年胡明华荣获“四川工匠”称号。



胡明华的一鸣惊人要从 2008 年说起。2008 年 5 月 12 日，汶川发生地震后，胡明华带着 13 名师生组成技术服务队，深入灾区支援灾后重建。在一个多月里，他们冒着余震的危险为东方汽轮机有限公司修复各型数控机床 50 余台，其总价值近 1 亿元(见图 8-1)。



图 8-1 胡明华团队在地震灾区

“没有什么事是真能一蹴而就的。”在 2008 年以前，胡明华已经“闭门修炼”近 10 年。

胡明华的工作地——四川德阳——是中国主要的装备制造业基地，拥有以中国二重、东电、东汽为代表的装备制造企业 1400 余家，胡明华逐渐成了他们的“老熟人”。他先后为各类企业、机构提供数控设备维修改造技术服务 500 余次，创造维修产值 700

多万元。他在对二重 8 万吨模锻机驱动装置、中科院成都光电所 DIXI 1200JIG 高精度数控机床主轴驱动系统等关键设备的维修中解决了多个重大技术难题，其中仅二重 8 万吨模锻机驱动装置维修一项就为企业节约 200 多万元。

在与企业的维修合作中，胡明华把每一次维修都当成一次珍贵的“解剖课”。为修复一台故障频发的荷兰生产的 HGG 相贯线切割机，他直接把设备放在自己的床边，通上电，昼夜观察。“有一天凌晨，我突然看到电路上面有个红灯闪了一下，可能只有零点几秒，然后就灭掉了。”那个转瞬即逝的一刹那，被胡明华抓住了。顺着这个线索，他最终发现一个元器件的故障，解决了国外专家都未能处理的难题。胡明华还说：“实际上换那个元器件，成本只要 5 毛钱。”

经过不断钻研，胡明华和他的团队从“维修”领域开始跨入“改造、研发”领域。在与一家拉链生产企业的合作中，胡明华成功研制出先进的全套拉链染色设备，使拉链染色成功率提高至原来的 4 倍。他所研制的染色设备还出口到美国等发达国家。

胡明华说：“使核心部件国产化，自己掌握核心技术，关键时刻我们才不会受制于人。希望能通过我们的努力，将核心高端设备的维修技术掌握在自己手里，为我们国家的重装企业保驾护航。”

在不断钻研技术的同时，胡明华非常注重技能型人才的培养，他将学生引入技术团队，让学生在实践中成长，还在团队内建立传帮带机制，培训、指导学生参加各类比赛，这种产学研结合的模式使学生们得以快速成长。

8.2B 智慧工厂



智慧工厂（概念图见图 8-3）是对现代工厂信息化的进一步革命。它主要利用物联网技术、设备监控技术掌控生产过程，可以清楚掌握整个生产流程，提高生产过程的可控性，减少生产线上的人工干预，及时、正确地采集生产线数据，同时合理编排生产计划与生产进度。



图 8-3 智慧工厂概念图

智慧工厂是实现智能制造的重要载体。在实现生产过程的智能化的同时，它还通过构建一个高效节能、绿色环保、环境舒适的人性化工厂，帮助企业实现端到端（消费者到生产者）的商业模式。

智慧工厂将最大限度地满足客户私人定制需求，比如：你需要定制一辆个性化汽车，要求车身是某种特殊颜色，或者座椅带电加热功能等（在目前的生产模式下是不可能做到这种程度的个性化生产的）。你通过手机就可直接把订单发送给厂家。生产系统自动从数据库中产生解决方案并送到生产线控制系统。

在汽车总装车间，发动机、座椅、车窗等随着传送带被运到生产线。这些零部件都有着包含“定制信息”的射频识别码，有条不紊地“告知”生产设备“我是谁”“我需要怎样的处理”“我要到哪去”。机器人扫描识别出它们的信息后从“沉睡”中“苏醒”，开始着手装配……直到汽车总装完成。

德国西门子安贝格工厂（见图 8-4）正在把此场景变为现实。安贝格工厂创建于 1989 年，如今该工厂每年可生产约 1500 万件 Simatic 产品。为了准确收集数据，安贝格工厂的超过 3 亿个元器件都有自己的“身份证”。这些基础识别信息包括：哪条生产线生产的、用什么材质、当时用的扭矩是多少、用什么样的螺钉等。当一个零部件进入烘箱时，机器会判断该用什么温度加热以及加热时间长短，并可以判断下一个进入烘箱的零部件是哪一个，并适时调节生产参数。在此过程中，Simatic IT 生产执行系统每天将生成并储存约 5000 万条生产过程信息。



图 8-4 西门子安贝格工厂

在安贝格电子制造工厂中，真实工厂与虚拟工厂同步运行，真实工厂生产时的数据参数、生产环境等都会通过虚拟工厂反映出来，而人则通过虚拟工厂对真实工厂进行把控，其中，近 75% 的生产作业已实现自动化（见图 8-5）。产品可与生产设备通信，IT 系统控制和优化所有流程，确保达到 99.9988% 的产品合格率。

2013 年，安贝格工厂的姊妹工厂——西门子成都电子工厂（SEWC）在四川成都投产。SEWC 是西门子在中国的首家数字化工厂（见图 8-6）。SEWC 承担着西门子全球工业

自动化产品研发和生产的角色，产品主要包括可编程逻辑控制器（PLC）、人机交互界面（HMI）、工业计算机（IPC）等。通过西门子数字化软件套件和 Simatic 等产品及应用，SEWC 实现了从管理、产品研发、生产到物流配送全过程的数字化，并且通过信息网络与德国生产基地和美国的研发中心进行数据互联。



图 8-5 当今最现代化的生产设施



图 8-6 西门子成都电子工厂（SEWC）

在智慧工厂愿景中，现实和虚拟生产环境将融为一体。产品之间以及产品与生产系统之间可以进行通信，以便优化生产过程。到那时候，工厂将在很大程度上进行自我控制和优化。

8.3B 3D 打印

3D 打印技术出现在 20 世纪 90 年代，是一种累积制造技术，即快速成形技术。3D 打印机（见图 8-8）的工作原理是以数字模型文件为基础，运用特殊蜡材、粉末状金属或塑料等可黏合材料，按照程序一层层“打印”出真实的 3D 物体，最终把计算机上的蓝图变成实物。

3D 打印机与传统打印机最大的区别在于它使用的“墨水”是实实在在的原材料。堆叠薄层的形式多种多样，可用于打印的介质种类繁多，如塑料、金属、陶瓷及橡胶类物质等。





图 8-8 3D 打印机

3D 打印的设计过程是：先通过计算机软件建模，再将建成的三维模型“分区”成逐层的截面，即切片，从而指导打印机逐层打印。

3D 打印机是一种神奇的机器，几乎可以打印一切（见图 8-9）：房子、器官、汽车、衣服、珠宝、机器人……它可被用在工业设计、建筑、医疗、教育、地理信息系统、航空航天等很多领域。

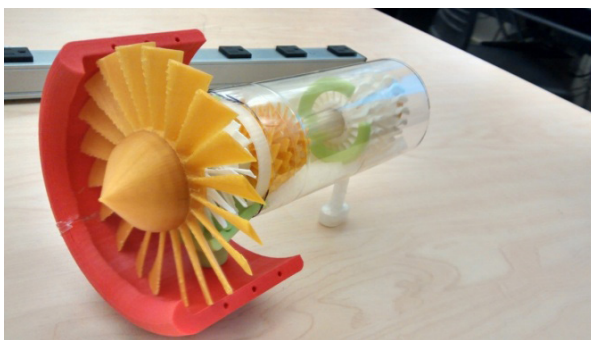


图 8-9 3D 打印喷射或涡轮机

2010 年 11 月，美国 Jim Kor 团队打造出世界上第一辆 3D 打印汽车 Urbee（见图 8-10）。

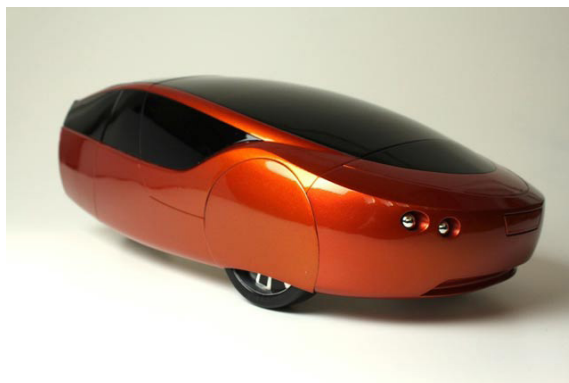


图 8-10 3D 打印汽车 Urbee

2012 年 11 月，苏格兰科学家利用人体细胞，首次用 3D 打印机打印出人造肝脏组织。

2014 年 9 月, 美国国家航空航天局 (NASA) 制成首台成像望远镜, 其绝大多数零部件都通过 3D 打印技术制造。这款太空望远镜功能齐全, 它的外管、外挡板及光学镜架全部作为单独的结构直接打印而成。

2015 年 4 月 22 日, 南方医科大学珠江医院利用 3D 打印技术指导完成复杂肝脏肿瘤切除手术。手术负责医生方驰华教授介绍, 这个手术复杂, 难度非常大, 如果不是借助 3D 打印的肝脏模型指导, 切除手术无法完成。

2015 年 7 月 17 日, 由 3D 打印的模块建造的别墅现身西安, 建造方在三个小时内完成了别墅的搭建。据建造方介绍, 这座 (耗时) 三个小时建成的精装别墅, 只要摆上家具就能拎包入住。

2016 年 4 月 21 日, 国内首台空间在轨 3D 打印机亮相重庆。空间在轨 3D 打印机的出现解决了空间站维修保障问题, 是未来完成深空探测任务的必要保障。据了解, 与只能在正常重力状态下工作的普通 3D 打印机相比, 这台空间在轨 3D 打印机可以在超重、失重以及正常重力状态下工作 (见图 8-11)。

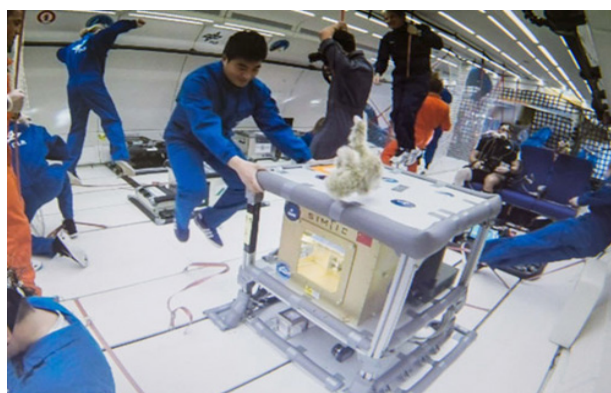


图 8-11 对空间在轨 3D 打印机的飞行试验

3D 打印机无需机械加工或模具, 它不再将物体分解成不同的部件, 分开生产然后组装。3D 打印机从计算机图形数据中直接创造出一个实际物体, 从而极大地缩短了产品的生产周期, 提高了生产率。3D 打印技术势必成为未来制造业的众多突破技术之一。

8.4B 中国四足机器人的发展

波士顿动力公司作为世界上最具影响力的机器人公司之一, 在过去的 25 年陆续研发出 BigDog、SpotMini 等四足机器人。与此同时, 中国的四足机器人研究进展又如何呢?



2011 年: 中国四足机器人迈出第一步

FROG 是由中国科学院自动化研究所王伟博士 (领导的) 团队发明的四足机器人。

它也是一个研究平台，用来开发和测试四足步态控制、步态转换和其他运动算法。王博士希望它能成为一个机器三角龙的骨骼模型。

FROG 使用 Linux 系统，采用无线的方式与控制它的计算机交互，不过在使用时它仍旧需要一个电源插头。（FROG 的）体内关节安装有加速传感器，能够模拟行走等。与波士顿动力公司的 BigDog 机器人采用的液压方式不同，FROG 使用直流电机驱动（见图 8-16）。



图 8-16 FROG 四足机器人

2016 年：“Running” 机器人夺冠

2016 年 9 月 6 日，来自中国山地四足仿生移动平台的国产机器人“Running”（见图 8-17）参加了“跨越险阻 2016”地面无人系统挑战赛，一举夺得 50 米速度和综合越野桂冠。该比赛结果令人振奋，我国无人平台的综合实力已经达到国际最先进水平，在部分指标上超越波士顿动力公司的 BigDog 机器人。



图 8-17 “Running” 机器人

“Running”采用汽油作为能源，航程较远，且易于添加燃料。行进速度为5~11公里/小时，甚至超过了人类步行速度。它能保持自身平衡，还具备在失去平衡时自行纠正，甚至重新站起继续行进的能力。能逾越车辆无法通过的障碍是它相对于无人驾驶车辆最大的优点。“Running”可作为通用平台，也可应用于复杂崎岖路面的物资搬运。

2017年：中国四足机器人对标美国最强产品

2017年10月，由中国机器人专家王兴兴成立的宇树科技公司研制了在性能上接近波士顿动力公司BigDog的四足机器人莱卡狗（该名字来源于太空狗莱卡）。

莱卡狗重量仅为22公斤却具有强大的动力系统，整机含12个高性能电机，瞬时最大功率为18千瓦。同时，它已经完全摆脱了外部供电。

宇树科技公司还模仿波士顿动力公司拍摄了一段测试视频。视频中，莱卡狗爬上了斜坡、穿过了石板路，以及再现了那个经典的被测试人员用脚踹的场景（见图8-18）。测试的结果是莱卡狗表现出了与BigDog一样的稳定性，但目前莱卡狗还不具备完全自主执行任务所需的视觉系统。



图 8-18 用踢踹的方式测试莱卡狗的稳定性

莱卡狗是科学家研究机器人的平台。随着进一步的改进，该机器人也可用于包裹传送等应用。

2018年：浙江大学研制四足机器人

2018年初，浙江大学熊蓉教授带领的机器人研发团队研制了“绝影”四足机器人（图8-19）。该机器人身長1米，四足站立时高60厘米，重70公斤。“绝影”靠电机驱动，载重可达到20公斤，行走速度为6公里/小时，续航时间为2小时。

“绝影”四足机器人已经掌握了跑跳、爬梯子、在碎石子路面上行走、自主蹲下再站起来等许多能力，有望在安防、侦查、救灾等实际场景中进行应用。

近年来，中国正在足式机器人领域努力追赶，如钢铁侠科技公司于2017年推出了双足仿人大型机器人，上海交通大学对外展示了六足机器人。据了解，目前国内还有

山东大学、哈工大以及军方等在研究（此类课题）。相信在不久的将来，中国四足机器人会赶上世界先进水平，甚至走在世界前列。



图 8-19 “绝影” 机器人

单元9 人工智能

9.1 人工智能对社会的主要影响



人工智能是一门研究和开发用于模拟和拓展人类智能的理论方法和技术手段的新兴科学技术，应用前景十分广泛。人工智能必将像人类历史上的其他重要科技变革一样，颠覆性地改变人类的未来生活。

谷歌执行总裁谈到人工智能对社会的影响时表示：人工智能是目前人类正在研究的最重要的事情，甚至比“电力或者火的意义更为深远”。但他指出人们对人工智能的担忧也是情有可原的。

人工智能对人类社会的影响主要有哪些呢？

1. 劳动就业问题

人工智能的崛起将导致“失业潮”的发生已基本成为行业共识。莱斯大学计算机工程学教授摩西·瓦迪表示，今后30年，人工智能将可以从事人类的大部分工作（见图9-1）。他预计：2045年人类失业率将超过50%。未来的收银员会因无人收银技术的普及而减少；卖场巡查人员会因智能摄像头的使用而减少；订货人员会因自动订货系统的运用而减少。无人银行、无人商店、无人驾驶汽车和飞机将越来越多地改变人们的生活。

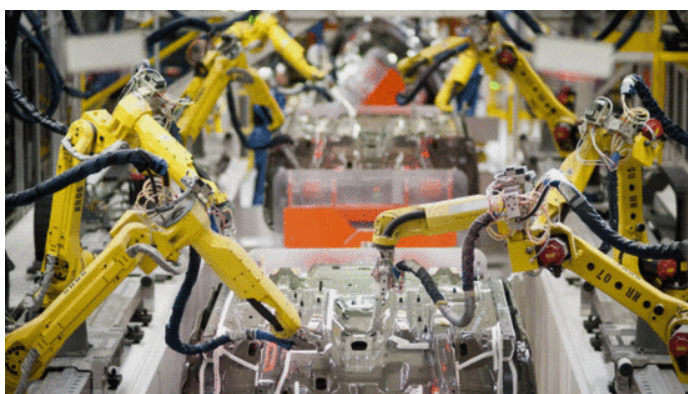


图9-1 机器人代替人的工作

2. 社会结构变化

人们一方面希望人工智能和智能机器能够代替人类从事各种劳动，另一方面又担

心它们的发展会引起新的社会问题。近十多年来，社会结构正在静悄悄地发生变化。“人—机器”的社会结构，终将为“人—智能机器—机器”的社会结构所取代。人们认为，现在和将来的很多本来由人承担的工作将由机器人来承担，因此人们将不得不学会与智能机器相处，并适应这种变化了的社会结构。

生活里随处可见的“工具型人工智能”已经无时无刻不在影响我们的生活了。让我们可以把更多的注意力从“枯燥重复的劳动性工作”转移到“感性抽象的创造性工作”上来。

3. 思维方式与观念的变化

人工智能对知识的掌握将会是动态的（不断增加和更新的）。人工智能越来越先进，互联网行业越来越发达，我们对人工智能的依赖越来越强，也许到最后只是一味地听取计算机给予的建议，（导致我们）认知能力越来越弱，让人类在日常生活中失去对问题的求知责任感，这或许才是人工智能真正的威胁。

4. 技术失控的危险

任何新技术最大的危险莫过于人类对它失去了控制，或者是它落入那些企图利用新技术反对人类的人手中。就像核武器，人类发明了核武器，可后来却发现根本无法控制它所将带来的恐怖影响。有人担心机器人和人工智能的其他衍生品威胁人类的安全。为此，著名的美国科幻作家阿西莫夫提出了“机器人三原则”：

- （1）机器人决不可以危害人类，也不允许眼看人类受害而袖手旁观。
- （2）机器人必须绝对服从人类，除非此行为违反第一原则。
- （3）机器人必须保护自身不受伤害，除非此行为违反第一和第二原则。

人工智能对社会的影响必将渗透到社会的每个角落，人工智能的发展是人类科学技术发展的必然趋势。面对这一趋势，我们应该保持积极乐观的态度，不断拓展，锐意创新，才能真正让人工智能促进社会的进步与发展。

9.2B 比尔·盖茨的智慧之家

比尔·盖茨的家名为“世外桃源2.0”，位于美国西雅图的华盛顿湖畔；豪宅占地面积达到5英亩，依地势而建，四周环绕众多桉木、枫树及花旗松等美国当地植物，（房屋）与周围的自然环境融为一体（见图9-4）。



1. “世界首富”的数字情结

整座建筑物铺设了长达84公里的光纤线缆；但是在墙壁上看不到任何插座或者线缆。供电电缆、数字信号传输光纤均隐藏在地下，其供电系统、数字神经网络系统会将主人的需求发至计算机、家电，让计算机能够接收手机与感应器的信息，并且让卫浴、

空调、音响、灯光等系统均能够“听懂”并执行中央计算机的命令。



图 9-4 比尔·盖茨家的外景

2. 贴心服务的“电子胸针”

来宾一进门，就会领到一枚电子胸针，特制胸针中设置了客人信息，会被作为来访资料储存到计算机中。无论他走到哪里，计算机系统都会探测出来宾的身份和所在的具体位置，在人工智能操作控制下，房间的灯光和其他设备具有自动调节的功能；音乐会跟随着你，因为墙纸背后安装了隐形的扬声器；胸针可以预先设定你偏好的温度、湿度、灯光、音乐、画作等条件；内置的传感器就会将这些资料传送至中央计算机，将环境调整到宾至如归的状态。

地板中的传感器能在 15cm^2 范围内跟踪人的足迹，当感应有人来到时自动打开系统，离去时自动关闭系统。

3. 科技智慧保障安全

科技赋予这所房子严密的安全屏障，入口安装有先进的门禁系统。系统一旦发现其他人来访就会通知主人，由主人向计算机下达命令，开启大门，发送胸针，方可进入。来宾如果没有胸针，就会被系统确认为入侵者，计算机就会通过网络自动报警。

当安全系统出现故障时，另一套备用系统就会自动启动。如果主人按下“休息”按钮，设置在房子四周的智能报警系统便开始工作。那些隐藏在暗处的摄像机可以做到无死角拍摄。同样不必担心火灾，住宅的消防系统会通过通信系统自动对外报警，并显示最佳营救方案，切断有危险的电力系统，并根据火势分配供水。

4. 令人叹为观止的智能设备

高科技在（比尔·盖茨的）智能家居中的应用足以让人惊叹，大门装有气象情况感知器，根据各种气象指标，控制室内温度和通风的情况。在厨房配置全自动烹调设备，

商业级厨房可为一百余人提供饮食服务。当然，（在住宅里）也有一个可容纳 24 人享受壁炉晚餐的专用餐厅。在厕所中还安装了一套检查身体的计算机系统，一旦发现异常，计算机就会自动发出警告。花园中，通过先进的传感设备可以 24 小时监控植物的生长情况，实现针对性的全自动浇水与施肥……

“比尔·盖茨的智慧之家”中的会议室保持全天接入互联网，可以随时召开视频会议。同时计算机还可以通过遍布房间的传感器，自动记录整座住宅的动静。

5. 比尔·盖茨钟爱的超级私人图书馆

盖茨豪宅的私人图书馆占地面积达 2100 平方英尺，在这个设计华丽并配有先进控制设备的图书馆内，有一个圆形屋顶的阅览室，屋顶中间有一个接收自然光的天窗，室内光线随着外界变化而调整（见图 9-5）。

在盖茨的私人图书馆天花板上，有一句来自《了不起的盖茨比》里的话：

当一个人奋斗了很久，
看到梦想如此之近，
他是不会轻易放弃的。



图 9-5 比尔·盖茨的私人图书馆

比尔·盖茨的智慧之家耗时七年兴建完成，为当今智慧之家的经典之作，它不仅华丽壮观，而且充满智慧，被誉为“未来之屋”。

9.3B 阿尔法狗

2016 年 3 月 5 日，人工智能阿尔法狗击败了围棋世界冠军李世石，引起了全世界对人工智能的恐慌。其实在 1997 年 5 月 11 日，计算机“深蓝”战胜当时的国际象棋世界冠军卡斯帕罗夫的时候，全世界的恐慌更为严重。但是



不少专家们认为“深蓝”也不过如此，而阿尔法狗的出现才是具有划时代意义的大事件。这是为什么呢？这绝对不是因为围棋比国际象棋复杂得多这么简单，而是因为阿尔法狗和深蓝（所使用的）算法截然不同。

“深蓝”的核心工作原理有两个，一是它记录了大量大师级的棋谱，（供其）在同样的局面下查阅使用，二是它用一个固定的公式根据棋子的位置和数量以及相似度较高的棋谱计算可选方案的分数，根据得分最高的方案进行下一步，所以说“深蓝”的每一步都是人告诉它的，而阿尔法狗的核心工作原理是“深度学习”。深度学习模拟生物大脑神经网络的工作原理，它的数学描述比较复杂，但可以简单地总结为——阿尔法狗的每一步棋都是根据自己“学习”所得而下出的。

“深蓝”的幕后团队包含了好几个国际象棋大师，而且从计算机硬件到软件都是专门为下国际象棋定制的，甚至为对付卡斯帕罗夫而定制的。阿尔法狗的幕后团队中最厉害的棋手不过是业余水平，但阿尔法狗可以在任何通用计算机上和任何棋手对局。

“深蓝”以 3.5 比 2.5 的微弱优势战胜卡斯帕罗夫，阿尔法狗以 4 比 1 的绝对优势战胜李世石（见图 9-9）。2017 年 5 月，它与当时全世界最优秀的棋手之一柯洁（见图 9-10）再次对决，比分为 3 比 0，中国的世界冠军柯洁没有任何胜机。

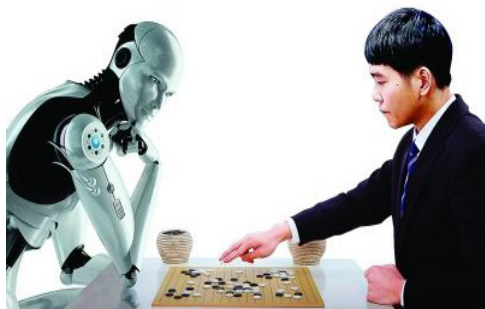


图 9-9 韩国棋手李世石



图 9-10 中国棋手柯洁

其实所谓的“智能”并非“上帝赐给人类的独特礼物”，它不过是动物对复杂的自然环境进行抽象、试错、选择的能力，其最早目的仅仅是为了适应环境，为了生存下去而已。因为人的精力是有限的，其某方面的“智能”通过终生的积累也不见得能做到“完美”，但是能“深度学习”的计算机通过不知疲倦地高速运转，在很短的时间内就能积累出超越人类水平的“智能”，比如阿尔法狗能在一天之内完成上百万盘对局，这是一个人一辈子也做不到的。

我们要认真去认识的并不是阿尔法狗，而是“深度学习”。深度学习不仅仅是用来下围棋的，还可以用在工业、农业、医疗、军事等领域。阿尔法狗象征着计算机技术已进入人工智能的新信息技术时代，其特征就是大数据、大计算、大决策三位一体，它的智慧正在接近和超越人类。

9.4B 射频识别



射频识别（RFID）技术是一种非接触式的自动识别技术，它通过射频信号自动识别目标对象并获取相关数据，识别工作不需要人工干预，可用于各种恶劣环境。RFID 技术可识别高速运动物体并可同时识别多个标签，操作快捷方便。

短距离射频标签不怕油渍、灰尘污染等恶劣的环境，可在这样的环境中替代条码，例如在工厂的流水线上用于跟踪物体。长距射频标签多用于交通上，识别距离可达几十米，可用于自动收费或识别车辆身份等。

最基本的 RFID 系统由三部分组成（见图 9-12）：

标签：由耦合元器件及芯片组成，每个标签具有唯一的电子编码，附着在物体上以标识目标对象。

射频识别器：读取（有时还可以写入）标签信息的设备，可设计为手持式或固定式。

天线：在标签和射频识别器间传递射频信号。

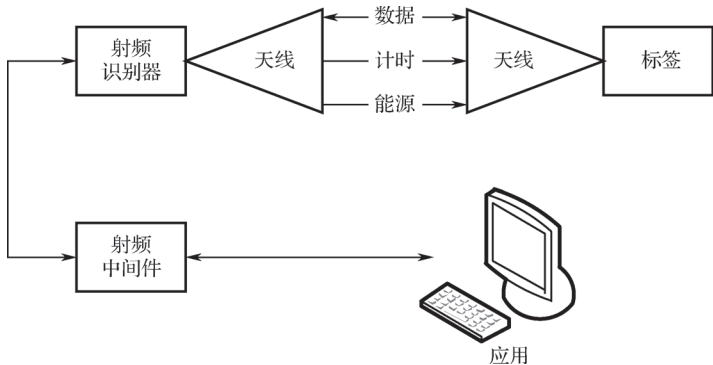


图 9-12 RFID 系统的组成和工作原理

RFID 广泛应用于我们生活的方方面面，当我们驾车出行时，要想快速通过高速公路出入口，ETC 是最好的选择。电子不停车收费是目前世界上最先进的路桥收费方式。通过识别安装在车辆挡风玻璃上的车载电子标签并将信息通过微波专用短程通信传给在收费站 ETC 通道（见图 9-13）上的微波天线，利用计算机联网技术与银行进行后台结算处理，可以达到车辆通过路桥收费站不用停车而自动支付路桥费的目的。

RFID 仓储物流管理系统对企业物流货品进行智能化、信息化管理，实现自动记录货品出入库信息、智能盘点仓库、记录及发布货品的状态信息、输出车辆状态报表等功能。依托 RFID 技术优势（的应用），此系统具有可对资产信息实现远距离识别、识别速度快、批量识别等特点。发挥 RFID 对各个作业环节进行实时信息采集的技术优势，可确保企业及时准确地掌握库存状态；通过仓储信息读写器对物资数据的采集，系统可实现物资出入库管理；通过手持设备可快速准确地盘点物资信息，提升盘点效率（见图 9-14）。

RFID 技术及其应用正处于迅速发展的时期，被业界公认为本世纪最具潜力的技术

之一，它的发展和应用推广将是自动识别行业的一场技术革命。



图 9-13 高速公路 ETC 通道



图 9-14 RFID 在仓储管理中的应用

后 记

学生的成长，老师的修行

“却顾所来径，苍苍横翠微。”历经 180 多天的努力，凝结着 17 名老师共同心血和汗水的《电气信息科技英语》终于完成了！

本书是由四川工程职业技术学院 12 位各学科专业课教师和 5 名英语课教师在大量查阅中外各类专著、教材、期刊论文以及网络资料的基础上，结合当前电气类和信息类的科技基础知识和前沿科技成果，经过老师们多次思想火花碰撞之后凝结而成的结晶。期间，参与编纂的老师们充分开展主题研究与自主学习，加强了同步交流讨论和结对协作，共同发扬刻苦钻研、精益求精的精神，相互信任支持，共同挑战难关，合作成长，历经多次挑灯夜战，终于高质量地完成了教材的编写工作。如今呈现给读者的这本书，每一篇文章，每一处细节，都是经过了编写老师们集思广益，并经过反复讨论修改而成的。

本书为读者呈现了一种新颖而独特的英语教学模式，书中有令人叹为观止的前沿科技资讯，其中选取的精彩故事肯定会激发学生和老师们对祖国领军科技的自豪感和对中华民族复兴的自信……初稿呈现之时，初阅的每位老师就为之惊叹：“这真是一本课堂改革之书、一本科技荟萃之书、一本弘扬民族自豪感之书……”，并叮嘱主编殷佳琳老师：“这本书出版后一定要给我一本！”

好书是由心血和努力凝结而成的。参与本书编写的大多数老师都是青年教师，有的老师不仅需要完成繁重的教学任务，还得照顾自己幼小的孩子，勤奋刻苦地抽出自己业余时间来完成编写任务。在参与本书编写的过程中，每位老师都付出了艰辛的努力，书中的每篇文章背后都有催人奋进、感人至深的奋斗故事。

高琦老师从头到尾参与本书的中英文资料选材、编写、审核和定稿，为了完成教材编写，连续数月起早贪黑，工作电脑里堆积了上千份编写文档，上百个文件夹，只能按建立时间以及资料分类标签才能迅速找出。更加难能可贵的是高老师的小孩尚在哺乳期需要照顾，编纂期间由于孩子生病，她只得不停地在医院、学校和家庭三处连轴转……由于天天熬夜，最后养成了一到午夜就睡不着觉的坏毛病。最夸张的一次，因晚上熬夜，白天又连续审稿，极度困乏的她的一次小憩中睡着了，家人先后给她打了二十多个电话都无回应。心急如焚的家人直接找到了她工作的地方，才发现她的手机就在她耳朵边不停地“疯响”……

参与英语教材翻译和核校的张雪老师，在完成学校的日常教学任务后晚上只能先行照料不满两岁的孩子，待其熟睡之后接着熬夜工作，而工作到午夜二、三点已经成为了那段时间张老师的工作常态；教学任务繁重的罗建芳老师，完成教材的英语翻译任务后多次带着孩子一起进行课程录制，力求在录制过程中寻找出最佳的教学效果；家中有两个小宝宝的初宏伟老师言必信行必果，是一位对每项任务都尽心尽职，力求保质保量高速完成的“超级奶爸”，努力地实现了工作生活两不误；家中无老人帮忙照顾孩子的张文君老师也是常常凌晨进行编写工作，书中关于“全球第一家无人银行”的文章题材就来自于她深夜3点多的一次素材搜索；王静老师因爱人在外地工作，仍坚持一边忙教学工作一边独自照顾一对双胞胎女儿，经过不懈的努力也顺利地完成了编写任务；范娟老师作为一位拥有两个小孩的职场妈妈，每天的教学和实训课程的任务都很重。早期她编写完成的资料因为题材另行更换不能再使用，她便立即加班全部重做，付出了加倍的努力；段国艳老师和钟艳老师都是积极主动、行动力强的编写老师，更是工作、带娃、教材编写三不误的“超级妈妈”；易欣老师、钟敏老师作为教研室主任，在承担繁忙的教学和行政工作之余，积极参与并完成了本书的编写任务；家在异地的魏庆星老师录课时废寝忘食，直到晚上九点半后才离开录播室；邓锋老师是学院英语专业的顶梁柱，作为四川省四、六级阅卷队伍中唯一的一位高职教师，承担了较多的文章翻译工作，并且还在阅卷工作之前连夜赶工，第一个将所负责部分的课程录制工作圆满完成；赵冠南老师、黄景广老师作为信息技术方面的专业教师，工作积极主动，承担了很多与教材编写相关的工作，完成了数量最多且最为繁杂的中文稿件编写、编辑和校对定稿工作。

在长达半年多的编写工作中，最辛苦的是主编殷佳琳老师。她负责教材的设计和统筹工作，总揽教材的构思和与老师们的沟通协调工作，无数次采稿、编写、重构、修改、校对，此外还无数次召开会议与老师们沟通……编写教材的核心任务都压在了她的肩头。由于各位老师分属不同的教学部门，要让所有参编的老师全员集中并开会讨论编写工作的困难较大，因此，为了开一次小小的碰头会议，殷老师常常需要到各个不同的地方单独找到老师们当面讲解沟通。为了保证编写质量，一次会议内容常常需要重复讲五、六遍。最令人担忧的是殷老师的眼睛被诊断为“植物神经性疲劳过度”，一旦发作则眼睛胀痛酸涩视力模糊。医生说最好的治疗就是休息，保养好眼睛，但是编写本书的工作何其繁杂，殷老师对工作精益求精的追求致使她经常不顾眼疾多次熬夜，导致短短时间内病症多次复发。于是她只好启动“外挂模式”——每天连续十几个小时编写、审稿、组织会议……中途只得间歇性地利用做饭、洗碗、洗衣服等短暂的家务时间让眼睛短暂休息。她爱人生气地批评她说：“这么拼命？眼睛瞎了可咋办？”但殷老师却一直忍着眼疾的疼痛坚持到完稿，她说：“编好教材既是为了学生的成长，也是老师自己的修行，不可半途而废！”

诚如殷老师所说，编书的过程中，老师们通过精诚协作和辛勤努力完成了一次知识的更新迭代和磨炼意志的职业修行！与此同时，本书也寄托着老师们的深情厚意和

殷切期盼！希望通过老师们的身体力行，能让学生们在学习书本知识的同时，真正做到不负美好韶华，扩展眼界和胸襟，懂得责任和担当的重要性，领会笃行和合作的意义，深悟“行是知之始，知是行之成”的真理。

人生也正如编书，只有经过多次精心修改，才能不断完善。在这个属于奋斗者的新时代，让我们乘风破浪，在有限的生命里用无限的行动力实现理想追梦和人生迭代！

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